REPORT OF CONSULTANCY ON DEMAND AND SUPPLY OF SKILLED MANPOWER IN POST-PRODUCTION SYSTEMS OF S.A.D.C.C.

by

by Manel I. Gomez and Denash P. Giga

November 1988

LIST OF TABLES

CONTENTS

1. EXECUTIVE SUMMARY

The consultancy on demand and supply of skilled manpower in post-production systems (PPS) in SADCC was undertaken by the authors of this report in April 1988. Country visits were completed over the period April-July 1988 and report preparation continued in the subsequent period.

The methodology employed was based on visits to, discussions and interviews with relevant institutions in the region. These included tertiary level academic and training institutions, ministries of agriculture, parastatals, marketing boards, international training projects and the food and agro-industry. A two-pronged approach directed by the terms of reference was used to:

i) Access the present market and demand for post-production skills and the projected demand over the next five year period.

ii) Evaluate the training capacity for these skills in the region.

A recognition of the need for post-production skills and training as integral to food security and food self-sufficiency was emerging at various levels in the countries visited. At least three of the countries, viz. Zimbabwe, Zambia and Mozambique, were in the process of planning degree programmes in Food Science and Technology. Six of the countries were incorporating Horticulture Production (including components of marketing and processing) into Agriculture curricula and agriculture research strategies, and four of the countries, Lesotho, Tanzania, Swaziland and Malawi, were re-examining the content and structure of Home Economics programmes to incorporate stronger components of Food Preservation and Processing.

The area of Grain Storage, Handling and Management has assumed importance in the context of national strategic grain reserves. Grain marketing organisations are assuming wider responsibilities in not only handling and managing larger volumes of grain than before (domestic, imported and food aid), but in having to ensure quality of the materials purchased and sold. There was therefore a higher level of interest and activity in the Grain Storage area within ministries of agriculture and marketing boards than in the processing aspects of production.

In processing, the major industries, milling, brewing, dairy, meat and sugar, both as private sector and parastatal organisations, appeared to be adequately served in manpower needs and training capacities. However the skills hitherto in demand were largely in the production and quality control aspects of food processing rather than in research and

development (R & D). The generation of employment and markets, however, depends on the R & D capacities to develop and diversify products and markets, to upgrade existing technologies and quality standards, and to maximize fully the available raw material and by-product resources. R & D capacity depends on the availability of higher level skills at graduate and postgraduate levels and the present glaring lack of university/polytechnic level training capacity (except in one country of the region, Tanzania) is a limitation that affects the growth of production capacity at all levels. This problem, therefore, deserves the highest priority in the region's curricula development and expansion plans and policies.

Present industrial capacity for training at vocational level in specific commodity areas, such as grain and sugar milling, is however well established in several countries. Though this cannot fully address the vacuum at higher levels, this infrastructural resource is seen as a viable and cost-effective means of strengthening regional middle-level skills through resource-sharing.

A limited number of international regional programmes exist in the SADCC, whose major or partial mandates cover training in post-production areas, e.g. meat technology, grain storage and cereal technology. These programmes and training opportunities should be made known in the region and be fully utilized. Where infrastructural capacity exists within these programmes it could be used to host and support other related overseas training courses to be run on a regional basis.

Several interventions and recommendations that fall within the purview and mandate of SADCC/PFIAU have been presented in the report.

It is recommended that SADCC/PFIAU:

- establish an information base of technical and professional personnel in post-production systems, training and research programmes, and facilities available in the SADCC region, based on background information provided in this report;

- catalyse and motivate a meeting of the Deans of Agriculture of SADCC universities to discuss the issue of post-production training, with particular reference to the agro-industrial development policies of their countries;

- promote and facilitate inter-sectoral and inter-regional meetings of universities, research, industry, government ministries to review needs and identify constraints to development of post-production manpower and resources;

- promote and seek sponsorship of post-production training and strengthening in priority areas;

- facilitate intra-regional networking between institutions and international programmes with post-production capacities;

- explore the potential of private industry and parastatal sectors to provide resource personnel and facilities for special areas of commodity training, e.g. short-term attachments to industry;

- encourage and facilitate recognised external programmes to run short courses within the region to benefit a larger number of regional candidates.

SUMARIO DO EXECUTIVO

A Consultoria sobre a Procura e Oferta de mão de obra treinada nos sistemas de pos-produçao na regiao da SADCC foi levada a cabo pelos autores deste relatorio em Abril de 1988. Foram feitas visitas aos diferentes paises durante um periodo que foi de Abril a Julho de 1988 e a preparação do relatorio continuou no periodo subsequente.

A metodologia empregue foi baseada em visitas, discussões e entrevistas com as instituicões relevantes na região. Estas incluiram instituições academicas e de formacão a nivel terciario, Ministerios da Agricultura, Paraestatais, Centros para Comercializacao (Marketing Boards), Projectos Internacionais para Formacao e Industrias Agrarias e Alimentares. Foi usado um processo com duas finalidades, segundo a orientacao dos Termos de Referencia, para:

1. Avaliar o mercado e procura actuais para treino em pos-producao e a procura projectada durante os proximos cinco anos.

2. Avaliar a capacidade para formacao para a obtencao deste treino na regiao.

Estava a emergir, nos paises visitados e a diferentes niveis, o reconhecimento da necessidade de treino e formacao em relacao a pos-producao como uma parte integral para a Seguranca e Auto-Suficiencia Alimentar. Pelo menos, em tres dos paises visitados: Zimbabwe, Zambia e Mocambique, estava-se no processo de planeamento de programas para cursos em Ciencia e Tecnologia Alimentar. Seis dos paises estavam a incluir a Producao de Horticolas (incluindo as componentes de comercializacao e processamento) nos Curricula de Agricultura e na Estrategia de Investigacao Agraria e quatro destes paises: Lesotho, Tanzania, Swazilandia e Malawi estavam a reexaminar o conteudo e estrutura dos Programas de Economia Domestica para incluirem componentes mais fortes de conservacao e processamento de alimentos.

A area de Armazenamento, Tratamento e Gestao de Cereais assumiu uma grande importancia no contexto de Reservas de Cereais Estrategicas, a nivel Nacional. As organizacoes de Comercializacao de Cereais estavam a assumir responsabilidades mais alargadas nao so em relacao ao tratamento e gestao de maiores volumes de cereais, do que anteriormente (cereais de origem domestica, importados e resultante de ajuda alimentar) mas tambem por terem de assegurar a qualidade dos materiais adquiridos e vendidos. Havia portanto, um nivel mais elevado de interesse e actividade em relacao a area de Armazenamento de Cereais, nos

Ministerios de Agricultura e Centros de Comercializacao do que em aspectos de processamento na pos-producao.

Em relacao ao processamento, as industrias mais importantes, Moagem, Destilacao, Lacticinios, de Carnes e de Acucar tanto do sector privado como paraestatal, pareciam estar apetrechadas de modo adequado em relacao as necessidades de mao de obra e a capacidade para formacao. Contudo, o treino procurado era grandemente no controle dos aspectos de producao e qualidade do processamento de alimentos em vez de nos aspectos de Investigacao e Desenvolvimento (I&D). A criacao de empregos e do caudal de comercializacao depende das capacidades de Investigacao e Desenvolvimento para se desenvolverem e diversificarem produtos e mercados, para se melhorarem a tecnologia existente e os padroes de qualidade, e para que se tire o maximo das materias primas disponiveis e dos recursos em produtos secundarios. A capacidade de Investigacao e Desenvolvimento depende da disponibilidade de niveis mais elevados de treino a nivel de licenciatura e pos-licenciatura e a actual falta chocante de capacidade de formacao a nivel de Universidade / Instituto Politecnico (com excepcao de um pais na reiao, a Tanzania) e uma limitacao que afecta o crescimento da capacidade de pos-producao a todos os niveis. Este problema merece, por isso, a mais elevada prioridade no desenvolvimento de programas da regiao e nos planos e directrizes de expansao da regiao.

A actual capacidade industrial para formacao, a nivel vocacional em areas especificas de artigos de primeira necessidade, tais como moagens de cereais e refinaria de acucar, esta, contudo, bem estabelecida nos paises, em geral. Embora isto nao possa preencher o vacuo a nivel mais elevado, este recurso em infraestruturas e visto como um meio viavel e efectivo em relacao a custos para o reforcamento do treino regional a nivel medio atraves de um partilhar de recursos.

Existe na SADCC um numero limitado de Programas Regionais Internacionais cujas finalidades maiores ou parciais cobrem a formacao em areas de pos-producao, por exemplo, a Tecnologia de Carnes, Armazenamento de Cereais e Tecnologia de Cereais. Estes programas e as oportunidades de formacao deviam tornar-se conhecidos na regiao e deviam ser utilizados na sua totalidade. Quando existe uma capacitacao das infraestruturas dentro de tais programas esta podia ser usada para hospedar e apoiar outros tipos de formacao, relacionados, levados a cabo fora de Africa, e que deviam ser organizados numa base regional.

Sao apresentadas no relatorio varias intervencoes e recomendacoes que caem dentro dos termos e mandatos da SADCC/PFAIU.

Em breve, recomenda-se que a SADCC/PFIAU:

- Estabeleca uma lista de pessoal tecnico e profissional relacionado com sistemas pos-producao, programas de investigacao e formacao e instalacoes existentes na regiao da SADCC e baseada na informacao dada neste relatorio.

- Incentive e motive uma reuniao dos Directores de Faculdades de Agricultura das Universidades da SADCC para que discutam o problema da formacao em relacao a formacao em pos-producao, com referencia especial as directrizes para o desenvolvimento agro-industrial dos paises respectivos.

- Promova e procure patrocinadores para a formacao pos-producao e para o reforcamento das areas prioritarias.

- Facilite uma rede inter-regional entre as instituicoes e com os programas regionais internacioanis que tenham capacitacao pos-producao.

- Explore o potencial do sector industrial privado e do sector paraestatal para providenciarem recursos em termos de pessoal e instalacoes para areas especificas de formacao tendo em vista artigos de primeira necessidade, por exemplo, ligacoes com a industria, a curto prazo.

- Encorage e facilite programas externos reconhecidos para que organizem cursos de curta duracao, na regiao, de modo a que um numero elevado de candidatos possa beneficiar deles.

2. PREAMBLE AND ACKNOWLEDGEMENTS

The Southern African Development Co-ordination Conference (SADCC) Projects Nos 6 and 7 of the Food Security Project, viz. Post Production Food, Industry Advisory Unit (PFIAU) requested the services of a study team to review and report on the status and requirements of post-production manpower in SADCC countries.

Team members Manel I. Gomez (formerly Course Co-ordinator of the MSc. Food Science programme at the University of Zimbabwe and currently Food Technologist at SADCC/ICRISAT) and Dr D. Giga (Lecturer in Crop Science, University of Zimbabwe) were successful in tendering for the above consultancy and commenced work on the consultancy in April 1988. The consultancy was continued, with a break of 6 weeks in the April-June period, through June and July 1988.

During this period the team undertook visits to the nine SADCC states, visited institutes of tertiary education and vocational training, marketing organisations, parastatals, other non-formal training programmes and processing facilities in these countries, conducted interviews with relevant personnel, inspected facilities and equipment and collected and collated relevant supporting documentation for preparation of the report.

The report is presented in two sections and includes a separate section on country reports for each of the individual SADCC states. Section II incorporates a synthesis of findings from and recommendations for the SADCC region.

The team acknowledges support, interest and encouragement provided by Dr S. Muchena, Deputy Secretary Technical, Ministry of Lands, Agriculture and Rural Resettlement. The consultants are also grateful to the SADCC/PFIAU team consisting of the project leader Dr A. Mosha, James Biscoe and Tunga Rukuni and to the office staff of SADCC/PFIAU for assisting in several ways with logistical support and for facilitating the work of the consultancy. Each of the persons listed in the Contacts listing (Appendix I) provided valuable information and gave willingly their time and their input is gratefully acknowledged.

3. PROJECT BACKGROUND AND OBJECTIVES

The mission appointed to advise on projects 6 and 7 of the SADCC Food Security Programme observed in their report that "one of the largest gaps in the development of a more effective post-production food system within the SADCC countries lies in the present fragmented approach both to industry and to research" (and development). The mission also perceived that the attainment of food security in the region was dependent not only on increased agricultural production but the sustainability of the whole food system through improved post-production technologies. A key to the attainment of these goals was seen as the improvement in the efficiency of both the physical and human resources that are consumed and employed in the post-production food system. Accordingly one of the major defined activities of PFIAU was to review and evaluate existing facilities for education and training in the post-production disciplines, throughout SADCC. To assist PFIAU in designing and implementing interventions aimed at strengthening and improving the post-production man-power situation, the consultancy to consider the supply and demand of skilled manpower in the post-production sector was offered. The consultancy had the following terms of reference:

- To survey the present and five-year projection of effective demand for skilled manpower in the post-production sector (PPS) of SADCC.

- To identify the skills in demand and to quantify the numbers required at each skill level, i.e. semi-skilled, artisan, journeyman, certificate, diploma, degree, post-graduate, etc.

- To study the curricula of all the full-time training institutions within the region and to identify specific post-production elements in the training offered.

- To ascertain the in-service training capacity within the post-production system and to identify shortage and surplus capacity areas.

- To ascertain output from each institution and figures indicating where their graduates have found employment.

- To recommend adjustments in the training curricula to bring the supply and demand for post-production skills into closer equilibrium.

4. METHODOLOGIES

The approach to information collection was primarily based on visits to, discussions and interviews with the relevant institutions in the regions. These included tertiary level academic and training institutions, ministries of agriculture, parastatals, marketing boards, international training programmes and the food industry. The evaluation included not only the training programmes per se but the infrastructural support systems and facilities and capacities as well.

In addition to direct interviews the consultants used a range of documentation as reference materials. This included agricultural and food security strategy statements, national five-year development plans, specific bi-lateral aid or international training programme documents and training curricula.

The documents listed in Appendix II were used as reference and resource materials.

Table 1 represents a breakdown of the institutional/ structural sources of post-production training and the types and levels of the training covered under the consultancy.

Table 1: Breakdown of training institutions and programmes

Institutional/structural sources	Type/level of training
Formal academic training institutions, e.g. universities, polytechnics, agriculture colleges	Degree and post-graduate degrees. Diplomas and certificate level training
Ministries of agriculture	Extension training, farmer training, graduate and post-graduate level training in collaboration with universities
Parastatals (including marketing boards)	In-house formal training programmes, preparing candidates for professional/ vocational certification. Non-formal on-the-job and in-service training (apprenticeship). Formal academic training in co-operative training programmes with institutions abroad, e.g. Kansas State University and ODNRI storage and grain handling courses attended by staff of the grain marketing boards. Regional/international, bilateral technical packages incorporating formal training programmes. Intra-regional informal training through co-operating institutions/agencies, e.g. training available through Blue Ribbon Milling School or through Grain Marketing Board, Zimbabwe, or through ADMARC, Malawi
Food industry	In-service training. In-service plus formal training for certification in association with recognised technical training centres such as City and Guilds, London. Industrial financing programmes within industrial training schools, e.g. milling schools, sugar industry training schools

SECTION I

COUNTRY REPORTS

1 BOTSWANA

Though the livestock industry has traditionally contributed the major share of agricultural GDP in Botswana, the dependence on importation of a large proportion of the basic food grains is a major concern of the National Food strategy. A declared aim of the National Development Plan 5 was a shift in emphasis of government policy from the livestock to the arable sector. Accordingly, Arable Land Development (ALDP) is earmarked for the largest share of agriculture sector development funds within the next NDP period. Livestock development programmes have also within the current NDP period been diversified to include pig, poultry and fisheries production. These indicators and the increasing commitment to a National Food Strategy to ensure national food security, through measures such as the Strategic Grain Reserve, have serious implications for the mobilization of resources not only in the production sector but also in the post-production areas of storage, marketing, and processing.

1.1 Schedule of visits

- Botswana Agriculture Marketing Board (BAMB)
- Southern African Centre for Co-operation in Agricultural Research (SACCAR)
- Department of Agriculture Research, Ministry of Agriculture
- Botswana Meat Commission (BMC)
- Rural Industries Innovation Centre (RIIC)
- Foods Laboratory, Botswana
- FAO Regional Centre for Meat Inspectors and Meat Technologists
- Botswana Development Corporation (BDC)
- Botswana Agriculture College (BAC)

1.2 Botswana Agriculture Marketing Board (BAMB)

Person contacted:

Mr S Taukubong, Deputy General Manager

BAMB was established in 1974 to provide local farmers with an effective marketing system for their crops. All produce for export as well as imported grain passes through BAMB. BAMB currently covers the marketing of cereals, maize,

wheat, sorghum, millets and legumes. BAMB owns and operates a comprehensive network of depots and currently controls through agents and co-operatives 27 depots with a capacity of 55 000 tonnes, serving all the arable production areas, and three large silos of 25, 28 and 30 000 tonnes grain capacity. A targeted strategic grain reserve of about 80 000 tonnes is being envisaged.

1.2.1 Human resources infrastructure and training

1.2.1.1 Marketing

The cadre consists of one marketing officer and two marketing assistants. In the past training had been funded through Canadian Aid fellowships and over the last 10 years, only two officers had received training on the short course on Grain Storage and Marketing (7 weeks) offered by the Food and Feed Grain Institute of Kansas State University (KSU), USA.

1.2.1.2 Technical

At intermediate technical levels, Depot Managers responsible for the technical and management operations of the depots are recruited with a Certificate of Agriculture awarded by Botswana Agriculture College (BAC) or a Cambridge Senior School Certificate, and undergo on-the-job training in all aspects of depot management including grain handling and storage. A single Pest Control Officer is currently responsible for monitoring pest control activities at all the depots and for imparting some informal training to depot managers in special aspects such as fumigation. The Pest Control Officer has had no formal training in pest control procedures and has acquired on-the-job training and experience. BAMB currently has no resources for running in-house formal training in grain storage, pest control, fumigation and safety. In view of the planned Strategic Grain Reserve this would soon become a necessity or alternative recourse to regional training facilities, such as the Grain Marketing Board (Zimbabwe) training school, will be needed.

Purchasing officers are responsible for some extension (advisory functions at farm level relating to on-farm storage practice, grain quality requirements such as moisture content and how to meet these requirements).

Training for these officers in aspects of grain quality relating to grades and standards and a capability for grain quality measurement and evaluation through a quality testing/grading facility are foreseen as essential developments.

During the NDP 5 period BAMB had no responsibility for control over commercial seed production. This function, now being handled by the Department of Agricultural

Research, is to be taken over by BAMB in the current plan period and the BAMB facility will be equipped for cleaning, treatment, bagging and storage of commercial seed. The manpower and training implications of this development have not yet been worked out.

1.3 SACCAR

Persons contacted:

Dr M Kyomo, Director SACCAR

Dr D Wanchinga, Manpower and Training Officer

Dr Kyomo provided a brief overview on manpower training programmes being proposed and co-ordinated through SACCAR. In 1986, a meeting of the SADCC Deans of Agriculture had reviewed general agriculture training in the region and inter-university co-operation.

- GTZ has recently committed funds for the development of MSc programmes in specific subject areas among the SADCC universities and assigned specific disciplines to specific universities for these courses.

- A meeting is proposed for August 1988 for review of Agriculture manpower training needs in SADCC vis-a-vis qualitative market needs and development of appropriate curricula. This will involve recommendations for curricular change to adapt training to actual development needs.

- A regional workshop in Integrated Weed and Pest Management is to be held in Swaziland later in 1988.

- SACCAR-supported/sponsored regional projects/programmes essentially include a training component.

- As a matter of policy SACCAR will support and promote the post-production components of agricultural research.

1.4 Department of Agriculture Research

Person contacted:

Dr D Gollifer, Director

Dr Gollifer indicated that in the period 1960-70s, a Grain Storage Unit had been set up within the Agriculture Research Department through collaboration and participation of the Overseas Development Natural Resources Institute (ODNRI), formerly Tropical Development Research Institute

(TDRI), UK. The Grain Storage Unit had also developed an extension activity in the form of the Storage Extension Unit. These initiatives had failed to sustain themselves, probably for the lack of trained personnel to sustain the programme after the withdrawal of the British experts, and consequently the programme had lost momentum in subsequent years.

1.4.1

Manpower status in the department was briefly summarized as follows:

Total number of professional posts -
41 including administrators

Technical experts -
16 posts in this cadre but only
10 are currently filled.

Of the 41 positions, 18 are presently on training and 12 are due for training in 1988.

One horticulturist with a degree in horticulture was undergoing in-service training while two were currently abroad on postgraduate training programmes.

Research activities and programmes were mainly production-oriented except in horticulture, where production research and activities are closely integrated with the post-production storage, marketing and processing chain.

1.5 Botswana Meat Commission (BMC)

Person contacted:

Mr Mpuang, Personnel and Training Manager

BMC operates two abattoirs, one in Lobatse and the other in Maun, with a total annual throughput of about 300 000 head of cattle. A third abattoir is planned to come into operation in Francistown in 1990, with a slaughter capacity of 88 000. Besides cattle, BMC also provides facilities for slaughter and dressing of small stock, in the region of 4 000 goats and 3 500 sheep/annum. The BMC operates one of the nation's largest foreign exchange earning operations and has a beef export quota to the EEC market which is likely to increase in the future. The post-production operations of this organization therefore should claim a significant share of attention in the post-production human resource and infrastructure development efforts of SADCC.

1.5.1 Training and human resource development

Production line personnel in the Slaughter, Dressing, Canning and Tanning divisions are recruited with a Cambridge school leaving ("O" Level) Certificate, and given 24 months intensive in-house on-the-job induction and training. Of these, candidates showing development potential are selected for further training on a 2 year Diploma Course in Meat Technology in the UK, Australia or New Zealand. Such candidates have prospects of promotion to line management positions as foremen, production assistants and production managers.

At higher supervisory and management level, currently several expatriate technical staff are being understudied by local counterparts on an intensive localization programme, summarized in Table 2.

BMC also provides facilities for training of Meat Industry personnel from the region, e.g. two trainees from Zambia underwent training within BMC in 1987-88. Such training is arranged on a case-by-case basis and not as a formal scheduled programme.

1.6 FAO Regional Training Centre for Meat Inspectors and Meat Technologists in Africa

Person contacted:

Dr E D Bellino, Animal Health and Meat Hygiene Officer

The Centre was established in response to findings of a survey of manpower needs in the meat industry in Africa, carried out in 1977, which projected a demand of about 1 500 meat technologists.

However, since its establishment in 1984, the Centre has been able to train only 300 candidates so far, for the whole African region.

Training centre facilities include, in addition to lecture halls and laboratories, a pilot slaughter facility and a meats laboratory. The BMC facilities are also used for additional practical training. The Centre caters for an intake of about 36-42 students per course, with courses running two times per year.

Admission to the course is on the basis of a country quota system of two candidates per country per discipline. To qualify for admission candidates should have some previous practical experience in livestock production, health, or in the meat industry. The Centre is receptive to special requests from SADCC countries for short courses on special topics such as canning, curing and other meat processing technologies.

The course curriculum includes the following topics under Meat Inspection and Meat Technology respectively:

Meat Inspection	Meat Technology
Anatomy	Butchering
Physiology	Dressing and Cutting
Microbiology	Slaughter Yield
Pathology	Refrigeration
Hygiene	Meat Processing and Preservation, Canning, Drying, etc.
Epidemiology	By-products Utilization
Food-borne Diseases	
Meat Inspection Legislation	

A detailed course outline/description was not available.

1.7 Botswana Development Corporation (BDC)

Person contacted:

Mr Bons, Crops and Irrigation Specialist

The Commercial and Industrial Division of BDC consists of 51 companies employing nearly 4 700 personnel. Of these, those projects/industries in the area of food storage, marketing and processing are listed in Table 3.

Table 2: Summary of technical staff status at BMC

Position	Currently filled by	Understudy	Target date for localization
Production			
Works Manager	1 Expatriate	2 Locals	?
Cannery Manager	4 Expatriate	2 asst. canning managers under training abroad	Post 1 - 1990 Post 2 - 1997
Quality Control Manager	1 Expatriate	1 Local	1989
Tanning	2 Expatriate	6 trainees (Zimbabwe) followed by Diploma in Leather Manufacturing, UK	-
Laboratory Microbiologist	1 Expatriate	1 Local at Kenya Polytechnic, Food Technology; 1 trainee at CSIR, South Africa	1988 -
Engineering			
Chief Engineer			Localized
Production Engineer	1 Expatriate	Trainee on HND course	Nov. 1988
Plant Engineer	1 Expatriate	Trainee on HND course	Nov. 1990
Electrical Supervisor	1 Expatriate	Trainee at local Polytechnic	1989
Senior Engineer	1 Expatriate	1 Local	Jan. 1990
2 Mechanics	-	Local	June 1989
Engineering Draughtsman	-	Local	Dec. 1989

Table 3: BDC - Food marketing/processing enterprises

Name of Company	Operations	Employment
Bolux Milling	Silo capacity of 32 500 tonnes; Milling and packaging (wheat) 200 tonnes per day	186
Kgalagadi Breweries	Major beer brewer and soft drinks manufacturer	465
Sefalana Botswana Limited	Maize milling (50 000 tonnes maize meal per year); Food processing and wholesalers	1 005
Sugar Packers (Pty) Limited	Packaging and distribution of white and brown sugar	142
Botswana Breweries	Production and packaging of opaque beer and Mageu	285
Maize Milling (Francistown)	Maize meal production and packaging	n.a.
Maize Milling (Mochudi)	Maize meal production and packaging 100 000 tonnes per year	n.a.
Milly's Bakery	Bakery	50

BDC Agriculture Division

The Division is responsible for four farming companies engaged in production of a range of crops, including maize and horticulture crops such as potatoes, vegetables (cabbage, onion, tomatoes) and mushrooms. In the Tuli block, the BDC has improved small farmer pilot settlement schemes for irrigated fruit (citrus) and vegetable production. However, the integration of these schemes with marketing and processing facilities for targeted farm surpluses has not yet been accomplished. These developments would probably accompany the BDC's projected expansion of irrigated area on its Talana farm (from 315 to 470 hectares) and its Seleka farm (from 109 to 280 hectares). The success of these expanded production schemes will depend on the capabilities and skills in the post-production aspects of these crops and there is a need to initiate training in these areas. The BDC had under training three Agriculture graduates, two of whom were presently undergoing further training abroad. Six diplomates (BAC) were currently employed with two diplomates being assigned to each of the BDC farms. The total cadre provided for ten diplomates.

Private investment in vegetable processing (tomato products) had been initiated but BDC had not as yet explored the marketing and raw material supply possibility to the processing industry. The projects department of BDC has secured land for a substantial food-processing project for a multinational food-processing concern.

1.8 Botswana Agriculture College/University of Botswana

Person contacted:

Prof G Mrema, Dean, Faculty of Agriculture

The University of Botswana has embarked on a programme for development of a Faculty of Agriculture. The current Botswana Agriculture College is to become a constituent college of the University, offering both Diploma and Degree level training in Agriculture. The planned degree programme will consist of a four-year course, based on "O" level entry plus a six-month practical pre-enrolment period. The proposed faculty will be grouped into four Departments, viz:

- Agriculture Economics and Extension
- Crops and Soil Science
- Animal Production
- Agriculture Engineering and Land Management.

Inputs of crop processing and storage are expected to be included in the Agriculture Engineering curriculum. A separate programme/option in Food Processing/Technology was not considered an immediate need but is a likely future development. Extracts from the curriculum (in planning phase) covering post-production aspects of post-harvest handling and processing are listed below.

1 Horticulture (30 lectures 30 practicals) includes harvesting, processing and marketing;

2 Agricultural Processing (30 lectures 15 practicals) covers post-harvest operations, crop-handling-threshing, cleaning, grading and packaging, storage, on-farm operations, milling, mixing and rural processing;

3 Livestock Management (60 lectures 30 practicals): handling, processing, preservation and utilization of livestock products, milk, cheese, butter, glue, eggs, meat.

1.9 Rural Industries Innovation Centre (RIIC)

Person contacted:

Mr Solly Dinat, Business Manager

RIIC, located in Kanye, is a non-profit organization operating under Rural Industries Promotions (RIP). The broad objectives of RIP have been the promotion of small industries through training and structural support. RIIC has made a significant contribution to the promotion of rural scale food processing through development and dissemination of sorghum dehulling technology. Other food processing activities include a bakery project. Apart from developing and disseminating the design and technology for these projects, RIIC has a training function which is carried out through training courses, training materials and manuals. RIIC has run several courses and training sessions on sorghum dehulling and the bakery projects. Trainees are drawn from all levels from the community, government departments and prospective customers interested in purchasing the milling or baking equipment and technology.

1.10 Foods Laboratory Botswana

Person contacted:

Mr V Sharma, Manager

The Foods Laboratory operates under the Botswana Development Corporation. It was originally set up to

service the needs of a canning project in the northern region of the country and remained defunct for a while before it was revived in 1985. The unit consists of a small analytical and foods testing laboratory and a processing facility.

The processing facility is equipped mainly for canning and fruit and vegetable processing. Since 1987 the Foods Laboratory has acquired two food specialists with BSc and PhD level training in Food Science and Technology who are working on an active development programme of research and services. Several projects have been formulated for funding including sorghum-based product development, solar drying and a weaning food project. With appropriate funding the existing infrastructure and staff base of this unit could be strengthened to serve as an important support system to organisations such as RIIC and BDC.

1.11 Food Resources Department (FRD)

The Department of Food Resources, established in May 1982, is responsible for ensuring distribution and access to basic foods throughout the country during drought or other calamities. FRD is also responsible for the receipt and distribution of food donations received by the country for relief or institutional feeding.

The storage capacity of the Department is to be expanded from 6 700 tonnes to over 17 500 tonnes, with storage depot facilities to be constructed in 13 locations over a three year period. Training needs to meet this expansion have already been identified at central government level. Training programmes being planned are for key personnel in short 2-3 month regional courses in:

- Warehouse and Personnel Management (FRD and BAMB), and
- Grain Marketing and Accounting (BAMB).

2 MOZAMBIQUE

2.1 Schedule of visits

- Agricom
- University of Mozambique
- Instituto nacional de Investigatao Agronomica (INIA)
- Unidad Direcion Duramo Alimentar (UDRA)

2.2 Agricom

Persons contacted:

Miss D Duncan, Technical Officer

Mrs L Come, Personnel Officer

Mr Nacimento, Head, Technical Department

Mr Hernando da Silva, Marketing Officer, Supply Department

Agricom is the state organization responsible for the purchase and marketing of scheduled crops including grain, legumes and cassava.

Agricom handles about 136 000 tonnes of produce distributed among 126 warehouses at provincial and regional level. The Technical Department runs short courses at provincial and regional levels for warehouse managers and storekeepers on storage grain handling and management, store sanitation, pest control safety and fumigation practices. The training programme has been funded by UNDP and four courses are run in the Central, Southern, Northern and Maputo zones for regional workshop managers. The courses cater for about 20 participants per course. Requests for training are also received from private warehouses and the Ministry of Trade, but training capacity is limited. Services such as fumigation are carried out by Agricom on a fee basis.

A major problem is the low education standard of depot and warehouse managers, whose formal educational standard is usually 4th or 5th grade level, and their low management skills.

Ten storage inspectors are responsible for inspection and monitoring of the 120-130 stores, nationwide, and within this category of staff now the Agricom buying agents have adequate training in procedures for checking grain quality in storage or at purchase (grading).

The buying agents receive 2-week training courses conducted at provincial level. However more intensive training is being planned with Portuguese-speaking countries such as Brazil. One Mozambican is currently involved in the Grain Storage and Marketing course at KSU while training for a second Mozambican is being arranged through the British Council.

Since the grain storage function is dispersed among several ministries, e.g. State Trading Corporation of the Ministry of Trade, as well as among private organizations, there is need for a central service facility for grain testing and quality evaluation. Funding of about US$20 000 has been acquired for the establishment of a Food Quality Testing

Laboratory, expected to be functional by end 1988. A candidate having BSc Agriculture has already been identified as laboratory Manager/Supervisor while UNDP support has been provided for training of a technician.

Agricom is in the process of planning a 2-week training programme for about 6-8 provincial and technical Agricom staff to take place at GMB in January 1989. The training is to cover all aspects of storage under the GMB grain handling system and will include grading, stacking, moisture determination, and pest control. Two Brazilian consultants and two experts from the GMB will also visit Agricom to evaluate needs and advise on training.

2.3 University of Mozambique, Faculty of Agriculture

Person contacted:

Dr Jose Rodrigues Pereira, Director/Dean, Faculty of Agronomy and Forestry

The Faculty of Agronomy and Forestry consists of three Departments, viz:

- Crop Production (Production, Agriculture Economics, Plant Protection)
- Forestry, and
- Rural Engineering (Soil, Agriculture Mechanization).

The BSc Agriculture programme is a 5-year course with two years of common basic course work for all three Departments and three years of specialization in the major option.

Food Technology is being introduced as a fifth year special option, and about ten of a total of 90 students opt for Food Technology.

The infrastructure and human resource needs for a Food Technology Department are being developed. As part of the plans it is intended to use food industry facilities and resource persons for teaching, as well as to develop/rehabilitate the laboratories at INIA to serve as teaching laboratories for the course.

A candidate (Ms Leda Hugo) having a BSc Agriculture degree has been identified to take charge of the Food Technology Department of the Faculty. She has had one year's orientation/exposure within a range of food industries and further postgraduate training is being planned.

Storage and post-harvest primary processing such as cleaning and threshing have been covered in several crops, agricultural mechanization and sanitation courses. Italian

bilateral aid programmes have been and are providing funding through a Technical Aid Package providing equipment, training and staff exchange.

Technical training for middle-level technicians is available through the course in Industrial Chemistry provided at the Technical Training Institute (under the Ministry of Education) located in Maputo and Beira.

The Food Technology curriculum for the fifth year option consists of 80 hours of lectures and practicals covering the following subject areas:

1 physical, chemical, nutritional and organoleptic characteristics of food;

2 biochemistry and physiology of plant products;

3 biochemistry and physiology of animal products;

4 physical and chemical techniques of food preservation;

5 machines and equipment for food preservation;

6 physical, chemical and biological methods of transformation or processing of food;

7 machines and equipment for food processing;

8 relations between preservation, processing and distribution/marketing of food products;

9 analytical methods of quality control;

10 study of the principal agricultural products of Mozambique: cereals, oilseeds, fruits and others.

A 48-hour course on pest control covers topics such as biological infestations, prevention and control of infestation, and characteristics of principal groups of pests.

2.4 Instituto Nacional de Investigacao Agronomica (INIA)

Person contacted:

Dr Manuel Moraes, Director, INIA

INIA represents the research activities of the Ministry of Agriculture, and deals with the major crops, cereals, groundnut, cassava, and legumes, oilseeds (sunflower, soya) and horticulture crops (tomato, citrus).

In the food processing/technology area it is evident that the availability of a critical mass of manpower is the first pre-requisite for a research programme.

Towards this end, INIA hopes to collaborate with and support the efforts of the Faculty of Agriculture to develop the Food Technology programme and facilities.

INIA facilities include a general analytical laboratory, a microbiology laboratory, a cereal technology laboratory and pilot bakery. These facilities are currently under-utilized for lack of adequate staff and resources. Maria Lourdes, a trained technician with several years experience in cereal technology, is deployed on other duties and the facilities are in a state of disuse, though most of the equipment has been maintained in working order. Some processing activities/interests, such as the production of fruit wines, are however continuing. With the sorghum production programme gaining importance, interest was indicated in the acquisition of a sorghum dehuller for supporting processing/utilization research.

2.5 Unidade Direcion Duramo Alimentaire (UDRA)

Person contacted:

Mrs Lara da Silva Carrilho, Food Technologist

UDRA is the State Secretariat responsible for light and food industries. UDRA co-ordinates training, quality testing and standards and advisory services for nearly all the food processing industries, the most important ones being:

- Maize and wheat milling
- Bakeries
- Fresh yeast manufacture
- Fruit juice extraction
- Milk processing
- Butter repacking
- Sweets, chocolate and confectionery
- Oil processing
- Brewing

UDRA is responsible for the framing of food laws and regulations. The Food Technology Division of UDRA runs three courses per year for food industry personnel. The courses are intended for production technicians and line supervisors. Course components include theoretical and practical aspects of food processing and fundamentals of Food Chemistry, Microbiology and Food Technology. The training service is operated with collaboration from resource persons from industry. However UDRA staff resources are grossly inadequate to meet the demand for services. Some part-time regular assistance has been

provided by a dairy technologist from industry. Technician grade staff usually have formal education up to 9th Grade followed by a three-year Diploma at the Technical Training Institute. In industry, too, there is a severe shortage of trained staff at all levels from plant managers down to production assistants and operators.

UDRA is a parastatal organization funded by industry and some allocation from the central government budget. Microbiological and safety standards for food are implemented in collaboration with the Ministry of Health, Public Health Laboratories. UDRA is interested in exploring the regional possibilities of industry in-house training programmes such as those provided by the Milling School of Blue Ribbon Foods, Zimbabwe.

3 MALAWI

3.1 Schedule of visits

- Bunda College of Agriculture, Department of Home Economics, Department of Crop Science, Department of Agricultural Engineering, Dean Faculty of Science
- Malawi Dairy Development
- ADMARC
- Ministry of Agriculture, Department of Research
- Natural Resources College.

3.2 Bunda College of Agriculture

Person contacted:

Dr Ngwira, Dean

A project for the establishment of a Centre for Agriculture Research and Development (CARD) within Bunda College and the University system had already received Government approval and is expected to come into operation within the next Five Year Plan period. Food technology/food processing activities have been provided for within the functions of CARD which will have farming, research and advisory functions and will integrate inputs from the various disciplines/departments at Bunda College as well as those from other sources, industry, parastatals and other government ministries. The work of the Centre will be contributed to by postgraduates, post-doctoral candidates and international experts. Initially 5-6 core professional staff are envisaged. Support staff at technician level will be available through the Laboratory Technology course

offered at the Polytechnic and will undergo further on-the-job training in specific areas such as Food Technology.

CARD will also collaborate and interact with other post-production and processing projects such as that of the Malawi Fisheries Development Corporation Fish Processing Unit in the south.

3.2.1 Department of Home Economics

Persons contacted:

Dr B Mtumuni, Head of Department

Mrs G Cussack, Lecturer in Nutrition

The Home Economics Department has at present an establishment of five posts. Of these, two positions are held by nutritionists and one by a candidate in training for PhD in Food Science at Michigan State University, USA, and expected to return in 1989.

The Department has faced an increasing demand for Food Science/Food Technology expertise from several sectors, such as Ministry of Agriculture, Community Affairs and Womens Groups, etc., for technical advice and inputs into projects such as rural scale oil extraction, home preservation of horticulture products, etc. An attempt has been made to fill this gap through increased inputs of Food Science topics in the revised Home Economics curriculum. With the strengthened staff position anticipated with the return of the PhD trainee, Dr Mtumuni was optimistic about achieving a more balanced programme of teaching and research with an appropriate representation of Food Science in the curriculum. Already research collaboration was ongoing between the Departments of Home Economics and Agricultural Engineering who are co-operating on a fruit and vegetable solar drying project.

3.2.2 Department of Agricultural Engineering

Person contacted: Head of Department.

The Department of Agricultural Engineering is likewise attaching more importance to storage, preservation and process engineering. The Department expects both in research and teaching to collaborate more with relevant processing industries in the country. Current research activities in processing and storage include:

- crop drying (solar and mechanical)
- preservation
- groundnut shelling
- oil extraction
- crop storage

Future plans include provisions for:

- specialization in processing at BSc and MSc level;
- an academic appointment of a crop processing and storage specialist;
- a laboratory for crop storage and processing research;
- extensive research in small scale processing for small-holder farms.

3.2.3 Department of Crop Production

Person contacted:

Dr Chiyenda, Head of Department

Post production topics such as post-harvest disease and pest control are covered in plant protection courses by two plant pathologists and one entomologist.

Horticulturists in training for PhD will cover post-production aspects of horticulture crops such as post-harvest physiology, maturity standards, harvesting, etc. Strong support was expressed for the development and expansions of Food Technology training at Bunda College and the integration of Food Technology with other Agriculture Production disciplines. The need for improvement of traditional technologies and improvement and documentation of traditional food resources was emphasized.

3.3 Ministry of Agriculture, Department of Research

Persons contacted:

Mr Sichinga, Chief Statistician, Food Security Co-ordinator

Ms I Chikagwa, Extension Specialist, Woman's Programme

Mr C Makato, Research Officer

Storage

A grain storage project initiated with ODA funding and support in the 1970s is now being continued at Chitedze, Mzuzu and Bvumbe Research Stations in the form of storage research, extension and training. A project on storage of seed potatoes and ware potatoes, funded by the Netherlands Government, is also on-going.

Processing

Primary processing research, and development activities relate to:

- groundnut shelling and development of an appropriate sheller, currently at stage of being field-tested;
- maize hand-shelling;
- rice thresher, modified for application to sorghum and wheat;
- sorghum dehuller being field-tested on-farm in IDRC-supported project in Shire Valley;
- horticulture.

Production aspects of horticulture development are catered for through several commodity specialists (Table 4).

Table 4: Horticulturists training abroad

Horticulture	Positions	Status of training
Established posts	9	-
Specialization:		
Temperate fruits	1	PhD in USA (OS)
Tree nuts (macadamia and cashews)	1	PhD in USA (OS)
Tropical fruits	1	MSc trained
Coffee	1	PhD
Vegetables and spices	1	PhD in USA (OS)

OS = On-stream

It is expected that in the period 1989-90, about 5-6 trained and qualified horticulturists will be in post. The researchers were unanimous in the criticism that with most technical aid programmes inadequate attention was paid to training local counterparts.

In this respect, ICRISAT efforts in providing training for one breeder and one entomologist were commended.

The need for supporting the horticulture and fisheries production programmes with appropriate capabilities for quality evaluation and control and development of food technology skills and capabilities was recognized as a priority. Existing extension services could not fulfil this function adequately, qualitatively or quantitatively. The present ratio of extension staff to farm units was 1:600.

3.4 Chitedze Research Station, Grain Storage Unit

Persons contacted:

Dr Sibale, Head of Station

Mr Kapiwa, Technician

Grain storage research and extension services are divided among three units located in Chitedze, Bvumbe and Mzuzu. The staffing of the three units is summarized in Table 5:

Table 5: Number of staff in the three Grain Storage Units

Grade/Level of skill	Discipline	Number	Level/Status of training
Professional/ Scientific	Entomology	1	MSc
"	Entomology	1	BSc
"	Agricultural Engineering	2	Posts vacant
Technical Grades			
Senior Technical Officers		2	
Technical Officer	Diploma Agric. (Bunda College)	1	On-the-job + ODNRI course in UK
Technical Assistants	General Cert. of Agriculture (Nat. Resource College)	5	On-the-job + ODNRI course in UK

To date, four technicians have attended short courses (6 months) on grain storage and marketing in the UK. In 1988, one technician will attend a similar course in the UK.

The units are engaged in grain and potato storage research particularly in relation to design and development of storage structures. Research programmes include on-farm testing and transfer of technology through extension and training of extension workers. The unit also provides services in insecticide testing, fumigation and pest control, phytosanitary and certification services. The potato research programme has developed storage structures permitting up to 5-6 months storage with spoilage losses of only 10%. The unit was also originally equipped to carry out Aflatoxin assays on cereals and groundnuts and has facilities and personnel to carry out these functions but has no support funds for purchase of chemicals.

It was urged that the FAO recommendation for developing the Grain Storage Unit at Chitedze into a Regional Plant Protection Services Centre be considered positively, and that funding be made available for periodic training updates of technical and professional staff to expose them to recent developments in techniques and instrumentation.

The grain storage laboratory at Chitedze is well equipped and good facilities exist at the Mzuzu and Bvumbe units.

3.5 Natural Resources College (NRC)

Persons contacted:

Mr F W Mbuka, Principal

Mrs D Mateyo, Head of Division of Farm and Home Science

The NRC is a residential training facility located in the Likuni area and provides practical, certificate-level courses for candidates who are admitted to the programme with a JCE (Junior Certificate of Education) or MCE with passes in English, Mathematics and at least one science subject.

The college has a training capacity of about 300-400 students/year and offers training in General Agriculture, Farm Home Science, Fisheries, and Forestry. The Farm Home Science course contains a Horticulture component of about 80 hours including aspects of farm processing and preservation of horticulture crops. Similarly, the Fisheries course provides processing inputs such as salting and drying.

The courses are designed to train middle-level technical manpower in Agriculture and Natural Resource disciplines;

to enter cadres of technical officer/assistant in government departments and the private sector. The 43 teaching staff reflect a range of specializations and levels of academic qualifications, from diploma and certificate level to BSc and MSc level.

Within the Farm Home Science Department, several projects focusing on post-production needs and activities have been initiated, viz:

- traditional processing of fruits, vegetables and fish (drying and preservation);

- home processing of fruit juices and fermented beverages and improvement of technology.

There is a serious interest in acquiring some input of Food Technology expertise to give these projects a more scientific and systematic approach, as well as to strengthen the content of the teaching curriculum in this area.

3.6 Malawi Dairy Development

Person contacted:

Mr Alan Walls, General Manager

Domestic milk production is currently short of national requirements. Post-production milk collection is organised by producer groups known as Bulking Groups, who deliver milk to the cooling centres, 17 of which are located in Lilongwe, 19 in Blantyre and 4 in Mzuzu. The bulking groups are responsible for operation and management of their centres. These groups and registered producers receive training in production and handling of milk, at the regional/provincial Farmer Training Centres.

Processing plant personnel, consisting of plant managers and superintendents, have undergone training at the FAO Dairy Training School, Naivasha, Kenya, or at the Dairy Technology Department of Egerton College, Kenya. Some of them have had additional 3-6 months practical attachments in dairy plants in Denmark. Training opportunities within in-house programmes of the regional dairy industries such as the Dairy Marketing Board (DMB), Zimbabwe, and the Kenya Co-operative Creameries have also been availed of. Currently, one production technician is undergoing training in yoghurt production at DMB, Harare.

The total work force at each of the dairy processing plants in Blantyre, Lilongwe and Mzuzu is 62, 54 and 20 respectively.

Technicians trained in quality control and dairy technology are responsible for controlling and maintaining milk and milk products quality at each of the plants. For public health and statutory quality standards these laboratories collaborate with the Central Veterinary Laboratories and with the Malawi Bureau of Standards. The MDD does not envisage large expansion in personnel and human resources needs in the post-production sector but foresees the need to initially increase the production capacity of the national dairy herd.

3.7 Agricultural Development and Marketing Corporation (ADMARC)

Person contacted:

Mr Butao, Regional Manager, Lilongwe

ADMARC is the major producer-purchasing and marketing organization in Malawi and handles all agricultural commodities: cereals, legumes, oilseeds, tea, tree nuts and horticulture crops. In addition to its marketing function ADMARC also operates a subsidiary fruit and vegetable canning activity based in Mulange.

Malawi has 59 grain stores providing a total capacity of 550 000 tonnes. In addition there are approximately 900 seasonal markets (bush markets) scattered over the country. Storage facilities hinge around 13 regional depots with a very high storage capacity and a system of 46 district parent markets with a capacity not exceeding 2 500 tonnes. Though there are only five large stores, they account for almost two-thirds of the country's storage capacity. Over 70% of the depots have a small capacity up to 5 000 tonnes.

Except for concrete silos at Lilongwe (strategic reserves) most of the stores are of rigid frame type, with steel walls and roof and concrete floor. Ventilation and damage by rodents are minimal in these facilities. The Corporation also stores grain in bags stacked under tarpaulins and in sheds.

The marketing function is carried out by the Market Officers under whom are the area supervisors and divisional supervisors. Each depot has a general manager and support staff.

3.7 1 Training

Marketing officers are recruited at two levels viz. those with high-school certificates and those with university degree/diploma. The former group receive extensive on-the-job training before being sent to ADMARC Training School at Limbe, while graduates/diplomates have a one-month orientation prior to the three-month training course at

Limbe. The course covers administration, management and technical aspects of marketing including some pest control and storage. The course is taught by ADMARC staff who are commodity specialists, by pest and quality control experts and by resource persons from other organisations such as the University.

3.7.2 Pest Control

Each region has a Pest Control Unit, headed by an Agriculture graduate who after 2-3 years in-service training receives specialized training at ODNRI (UK).

3.7.3 Quality Control

ADMARC facilities include on-site laboratory and testing facilities at regional level and a central laboratory at Limbe capable of more specialized commodity grading and quality testing such as Aflatoxin assays.

3.8 Malawi Grain and Milling (MGM)

Persons contacted:

Mr C Kwizambe, Manager

Mr F Gondwe, Head Miller

Malawi Grain and Milling, originally established as a parastatal organization, has gradually phased into a completely private enterprise. MGM has the largest milling capacity in the country consisting of three mills in Limbe, Lilongwe and Mzuzu with capacity of 30 000t, 15 000t, and 6 000t respectively. The Limbe mill in addition mills some wheat and stockfeed.

3.8.1 Training

3.8.1.1 Milling

Millers are recruited with basic City and Guilds qualifications and are given on-the-job training prior to specialized training in overseas milling schools such as Swiss Milling School, Indian School of Milling and German School of Milling. Five millers have been trained overseas while two millers are currently on training programmes in India and Germany. Six new recruits are currently in training on-job (two years) and will be sent overseas for specialized training. Grain and Milling has plans to establish a milling school to train its own staff.

3.8.1.2 Stockfeeds
The stockfeeds division at Limbe is headed by an Animal Science graduate with support production staff of four Agriculture diplomates.

3.8.1.3 Quality control
The well equipped quality control and cereal laboratory at Limbe is manned by one graduate chemist and one diplomate laboratory technician.

3.8.1.4 Pest control
Grain and Milling employs one expert in pest control who is responsible for the three mills and storage facilities. Each of the three mills has a team of pest controllers who receive training courses periodically from the pest control expert and ADMARC specialists.

4 SWAZILAND

4.1 Schedule of visits

Ministry of Agriculture:	Training Division Home Economics Division Dairy Division Research Station, Malkerns
University of Swaziland:	Vice Chancellor Department of Home Economics

Big Bend Sugar Company

4.2 Ministry of Agriculture

4.2.1 Training Division

Person contacted:

Mr Shabalala, Under Secretary, Training

Post-production aspects of agricultural/food crops, fishery and dairy production are covered by the extension services of each of the divisions within the Ministry, e.g. Home Economics Divisions, Co-operatives Division and the Fisheries Division. The Training Division of the Ministry provides training through formal residential training courses conducted at Farmer Training Centres. Currently three such centres are functioning but in terms of facilities, equipment and human resources these centres are in need of strengthening. Total extension staff strength stands at about 40 with a ratio of one extension worker to 400-500 farm units.

4.2.2 Home Economics Division

Person contacted:

Ms Christobel Motsa, Head Home Economics Division

Several food processing projects were at various stages of planning and implementation.

- Development of indigenous green vegetables as a valuable food resource and the preservation of these vegetables to combat seasonal scarcities.
- Composite flour mixtures, particularly legume cereal mixtures to be used as weaning foods.
- Preservation of fruits and vegetables by bottling and solar drying technologies.
- A germinated/malted cereal weaning food.

There is a lack of appropriate and adequate technical expertise for the formulation, project planning and implementation of these projects, though the grass-roots outreach infrastructure is well developed.

A Village Technology Centre, set up within the Ministry of Rural Development and with UNDP/UNICEF sponsorship, has been in operation since 1979, mainly as a demonstration centre, but has made no significant impact on or input into the development of viable rural food processing technologies.

4.2.3 Dairy Division

Person contacted:

Mr J. Mavuso, Dairy Officer

Swazi Dairy Board processes only fluid milk and has a daily processing capacity of about 10-11 000 litres while targeted requirement is about 36 000 litres daily.

The Board provides cooling facilities at two cooling centres and transport facilities for small farmers. Milk quality standards are monitored by the Dairy Unit of the Ministry of Agriculture.

The Production and Quality Control Managers of Swazi Dairy Board have undergone training in Dairy Technology at Egerton College, Kenya.

However, training for middle level production staff has ben a deficit.

A feed mill has been established as a subsidiary activity of the Swazi Dairy Board, for production of animal feeds, but it lacks the services of a qualified animal nutritionist and a feed analysis laboratory.

4.2.4 Ministry of Agriculture, Malkerns Research Station

Persons contacted:

Mr C T Nkwanyana, Chief Research Officer

Mr D M Gama, Senior Research Officer

Mr J Pali, Research Officer

The major post-production activities of the station are in the grain storage area. A subject matter specialist, the Agriculture Officer (Grain Storage), working within and in close co-operation with the research unit, has his own extension staff attached to the Grain Storage Unit. The extension staff receive on-the-job training in grain storage, storage structures and pest control, while the Agriculture Officer (Grain Storage) has had more specialized training overseas through FAO/UNDP funding.

The Grain Storage Unit is responsible for the purchasing, storage and marketing of grain, assisted by a Grain Handling Committee. The storage, pest control and fumigation functions relating to the five maize storage silos are a function of the Grain Storage Unit. Milling and processing are carried out by a private company, Swazi Milling, who is contracted to mill for the National Milling Corporation, a government-owned parastatal organization.

An ambitious Horticulture Development Programme has been initiated with IFAD funding for the National Agriculture Marketing Board which is responsible for the marketing of fresh produce. Twelve irrigation schemes are being planned at various locations throughout the country to support intensive horticulture production with a package of other inputs such as credit schemes and extension services for growers. Serving the twelve schemes will be a horticulture specialist in post-production handling and grading. A candidate identified for this position is currently undergoing two-month training abroad. In the first phase, the target is to encourage and promote sufficient production for consumption within the production areas and for the local market. However, with the favourable agroclimatic conditions in Swaziland, it is expected that surpluses in excess of local market demand will be produced and processing capability will have to be planned into the scheme. Present processing capacity is confined to a

monocrop, viz. pineapple (and some citrus) and is a large-scale export-oriented industry.

Plans are also being developed to increase wheat production and to establish wheat milling capacity in the country.

Of the 14 research staff at the station, five are out on MSc programmes, one on PhD, while the rest are all qualified at MSc level.

4.3 University of Swaziland, Faculty of Agriculture, Department of Home Economics

Person contacted:

Ms Margaret Silaula, Head of Department

Ms Silaula is a Home Economics graduate who has just returned from completing a MSc degree at the Department of Food Science and Human Nutrition at Michigan State University. The Department has provision for six teaching positions to be increased in the near future to ten.

All the current posts are filled with MSc qualified persons while one PhD is in training. The original two-year diploma programme in Agriculture, which had a Home Economics-biased Food and Nutrition component, has been replaced by a four-year degree programme leading to a BSc Agriculture. The curriculum was currently being revised for the proposed commencement of the course in the academic year 1989-90. The new curriculum includes strengthened inputs of Food Science topics such as Food Microbiology, Food Processing and Preservation. However the resources of facilities and personnel for Food Science teaching and research were considered grossly inadequate by Ms Silaula. The existing foods laboratory was only equipped for meal preparation and experimental foods practicals and Food Science teaching will have to depend on the resources of the general chemistry and biology laboratories.

The Home Economics Department has a capacity to train about 20-25 graduates per year with a maximum capacity of about 32 per year.

Other post-production disciplines such as Crop Storage and Farm Mechanization are currently being incorporated into the new curriculum. Ms Silaula strongly recommends the creation of at least one full-time post in Food Science and provision for training of a professional Food Science candidate for this post. She also sees the concurrent need for support staff trained in the Food Science disciplines of Food Analysis and Food Microbiology, for more opportunities for technician training and expansion of the cadre beyond the two positions now available.

4.4 Big Bend Sugar Company

Person contacted:

Mr Bayer, Training Manager

Big Bend runs in-house training programmes for its operator and production staff at its own training school, with supplementary external training in the more specialized technical areas.

Operator-level training consists mainly of training in engineering and workshop skills followed by on-the-job, factory floor training. In the third year of service the more promising candidates are selected for further training on the South African Pan Boilers course.

Supervisory grades of production staff are recruited with high-school certification, and undergo on-the-job training followed by a 13-week in-house training programme. Promising candidates may go on to a Diploma in Chemical Engineering (UK) and thus qualify for job advancement along production-management lines.

4.4.1 Quality control

A graduate chemist is in charge of the quality control laboratory. Laboratory technicians follow a 12-week Laboratory Workers Course in Laboratory Technology prepared by a South African correspondence school and conducted at the Big Bend Training Centre.

There are plans to expand production capacity of the mill but no staff expansion is envisaged.

5 LESOTHO

5.1 Schedule of visits

- Lesotho Flour Mills
- Ministry of Agriculture: Home Economics Division
  Extension Division
  Research Division
- Co-op Lesotho
- Lesotho National Development Corporation (LNDC)
- Food and Nutrition Development Corporation (FNDC)

- Lesotho Agriculture College, Department of Home Economics

- Basotho Fruit and Vegetable Canners

5.2 Lesotho Flour Mills

Person contacted:

Mr G M Begley, Technical Manager

Lesotho Flour Mills is a state-owned operation engaged in wheat and maize milling and in formulation and manufacture of stockfeeds. Of a total workforce of about 400, nearly 300 are engaged in production line activities.

For production staff, right down to machine operator level, Lesotho Flour Mills runs an in-house training programme providing opportunities for attainment of City and Guilds certification qualifications. This is provided through a City and Guilds correspondence course administered through the in-house programme and supported with in-house teaching material as well as practical on-the-job exposure. The course caters for about 24 candidates per year and of the candidates qualifying at this level, some are selected for further training in specialized grain milling technology at overseas centres such as Kansas State University.

Approximately two candidates per year have been supported for advanced training through USAID funds. Production control staff numbering about ten have all received specialized milling training, two of whom have undergone training at the Swiss Milling School. The training facility of the mills has also been used to train employees of Co-op Lesotho, particularly in aspects of grain quality grades and standards. The planned increase in production capacity from 8 tonnes per hour to 14 tonnes per hour is not to be accompanied by future staff increases.

It is expected that of the five expatriate senior positions in the Technical/Engineering Production Departments, three will be localized within the next four years.

The Central Quality Testing Laboratory is manned at supervisory level by two laboratory supervisors with degree level qualifications (BSc Chemistry) supplemented by a 6-month in-service training at Spillers Milling in UK.

The proposed feed mill when fully operational will need the services of an animal nutritionist and it is expected that these services along with the feeds testing laboratory will also provide nutritional and product testing services for product development for human feeding, e.g. weaning foods.

5.3 Ministry of Agriculture

5.3.1 Nutrition and Home Economics Division

Persons contacted:

Ms Anne D Tsiame, Nutritionist

Mrs P Matete, Acting Head, Nutrition Division

The Nutrition Division of the Ministry of Agriculture plays an important role in post-production extension services at the grass-roots level. Ten district field officers are assigned to the ten major districts throughout the country. At the district level about 10-14 nutrition assistants are assigned per district and one nutritionist supervisor serves each district. The field nutrition staff are trained to certification level at Lesotho Agriculture College in Rural Domestic Economy and Nutrition. However it is felt that the present level of training was inadequate to meet the needs of extension and advisory work, particularly in the post-production areas of food storage, processing and preservation, and that these areas need strengthening in the present curriculum. Arising from this deficit, the community-level nutrition training courses, offered through Farmer Training Centres to women farmers, likewise lacked adequate coverage of post-production areas.

Several women's groups organized through the Women Bureaus and the Rural Technology Services of the Ministry of Co-operative Development had initiated rural food processing projects such as solar food drying; however, the success and implementation of these projects was hampered by the lack of appropriate expertise.

An urgent and immediate need was expressed to upgrade the level of training of nutrition staff through 3-6 month intensive in-country courses. A proposal for funding such a training programme was under preparation.

5.3.2 Agriculture Extension

Person contacted:

Mr S Khetsi, Chief Extension Officer

Mr M J Koali, Senior Extension Officer

The established cadre for Extension consists of 250 posts, though less than 50% of the posts were currently filled. The shortage of extension staff and the constant turnover from extension into project activities were limiting factors, resulting in a very low ratio of extension staff to farm units of 1:1 000. Due to this constraint the

extension services provided with the available resources, were limited to general extension mainly relating to production. When special post-production inputs are required such as in the Lesotho Agricultural Production Institutional Support Project - USAID (LAPIS) Horticulture Development Programme, these would be provided through the project staff of that programme.

5.3.3 Research Division

Person contacted:

Mr T Namane, Acting Director

The research unit had two major storage projects, viz: on grain storage and on potato storage.

The grain storage structures project initiated in 1982 had developed brick structures to replace the traditional woven structures for grain storage. Three such experimental silos had been constructed in Butha district, as a pilot scheme, and a grain loss survey is now being conducted in Maseru.

Potato storage structures for seed and ware potatoes based on the Kenya designs had been experimented with and station trials as well as two on-farm trials using these structures were on-going.

Research staff unanimously complained of the shortage of support staff/field assistants for the supervision and data collection from field trials. This was seen as a pressing need and a constraint to getting research from station trials to the field.

Horticulture

Some research had been already initiated on several fruit and vegetable crops, and work is now moving from yield trials to selection of varieties for specific end use applications e.g. tomatoes for the fresh produce market and for canning, where two entirely different selection criteria are applied. Along with such developments is the need for a supporting laboratory service for quality assessment, incorporating capacity for both human and animal nutrition assays. This has been identified as a priority and a project proposal has been submitted to LAPIS for funding. The other major concern of all the researchers was the present level of agriculture training, i.e. the Certificate in Agriculture, which did not meet the minimum admission requirements for further advanced training abroad.

Upgrading this basic level of qualification to degree level was the only way candidates could gain access to further advanced training. Feasibility of an intensive in-country

training programme that would make up the deficits and upgrade competence of candidates with several years experience to diploma level, was suggested as an interim measure that SADCC could sponsor.

Agricultural Research Division
Availability and training of staff in post-production disciplines, is summarised in Table 6.

Table 6: Number of staff with training in post-production disciplines

	Available	On training	Completion date
Horticulture	1 MSc 1 BSc 1 Diploma	1 BSc (US)	1991
Nutrition (Request for two trainees, Diploma Food Science)	1 MSc		
Marketing	-	1 MSc (US) 1 MSc (US)	1990 1990
Rural Structures	1 Diploma	1 MSc (UK)	1989

5.4 Co-op Lesotho

Person contacted:

Mrs M Takahimane, Purchasing Manager

Co-op Lesotho is a trading and marketing organization dealing mainly in the major cereals, grain, maize, wheat and sorghum, and including legumes such as peas and beans. In the case of wheat and maize, where processing capacity is established farmers have the option of selling direct to millers. Pricing of produce is controlled by a Pricing Committee co-ordinated by the Ministry of Agriculture, but representing all relevant sectors such as farmers, millers and Co-op Lesotho.

The Co-op has 39 depots throughout the country with a total grain storage capacity of 35 000 tonnes. However, depot managers have no specific training in grain storage such as

pest control and fumigation and the Co-op is dependent on commercial agencies for these services.

There is also a deficit of training in grading standards and evaluation of quality aspects of grain. A training input in these areas for the Co-op's depot managers and storekeepers had been requested from Lesotho Flour Mills. A laboratory service for seed quality testing and grading of incoming grain is also an essential requirement.

Co-op Lesotho also operates a malting yard and packing plant as a subsidiary activity. The malting yard is currently operated as a manually controlled operation and has a production capacity of 8 tonnes per hour. The process involves a five-day germination and four-day drying period on the malting floor, followed by hammer milling, and therefore the malting output is low. There is scope for expansion of malting capacity with installation of a larger-scale mechanized malting plant of increased capacity (14 tonnes per hour). The packaging plant packs maize, and unhulled sorghum grain, pre-milled by custom milling, into retail maize and sorghum porridge meal as well as milled malt. The market potential for these products is promising and the operations are in need of trained personnel to upgrade the level of operators and volume and quality of the products.

5.5 Lesotho National Development Corporation (LNDC)

Person contacted:

Mr T Musiyambiri, Projects Development Officer, Agro Industries Division

LNDC is a parastatal organization responsible for planning/managing several agro-industry projects based on the rationale of producing and processing high-value crops in preference to traditional crops in order to maximize the economic output from the 13% arable land available in Lesotho.

A canning project has been developed, and is currently successfully operating, for the canning of asparagus (a crop well adapted to Lesotho's agroclimatic conditions). This project was initiated by LNDC as a pilot project and now operates as a subsidiary of LNDC. Negotiations are on-stream for transfer of the state-owned Lesotho Flour Mills to LNDC and an edible oil project based on sunflower is to be soon established as a private enterprise. Rosehips, a plant indigenous to Lesotho and valued for its high Vitamin C and micronutrient content, as a nutritional supplement, is to be commercially exploited through establishment of a processing facility for production of a concentrated rosehip extract. A local chemical engineering company,

with joint participation of Czechoslovak investors, has expressed interest in the project.

In all these projects, manpower needs and training requirements are assessed in the project planning phase and there is provision for manpower development support under a training grant scheme, where LNDC bears 75% of training costs.

5.6 Food and Nutrition Development Corporation (FNDC)

Person contacted:

Ms Mary M'Peta, Director

FNDC co-ordinates projects related to food and nutrition. An Interministerial Advisory Council administers activities of FNDC. NGOs engaged in food and nutrition activities are represented on the Advisory Committees. FNDC co-ordinates the work of several agencies.

Project supervision is carried out by four field officers at regional level, each serving three districts. The field workers are graduates in relevant disciplines such as sociology. FNDC is seeking sponsorship for further training of one of the field workers having a BSc (major in biology) in the area of Food Technology, since several projects involve food processing activities which require appropriate technical capabilities for planning, implementation, monitoring and assessment. With this capability FNDC could make training inputs into community projects such as fruit drying, which the Commission of Women's Affairs is interested in promoting and supporting. A consultant, to be funded by EEC is to advise on this project.

5.7 Lesotho Agriculture College (LAC)

Person contacted:

Mrs M T Pinda, Head, Department of Home Economics

The two-year certificate programme originally conducted by LAC is now being continued at the Agriculture College, Leribe. LAC now offers a three-year Diploma with three areas of specialization, viz: Agriculture, Forestry and Home Economics. The annual enrolment distribution among the disciplines is 35-40 in Agriculture, 16 in Forestry and 20-25 in Home Economics.

Common core courses are taken in years 1 and 2, with specialization in the options in year 3. The curriculum has recently been revised to include course units on methods of preservation and processing, with emphasis on

rural technologies, supported by a practical project in the third year, which may be based on a food processing topic. However, the Home Economics Department is staffed only by 5-6 Home Economics specialists and Education majors and lacks a professional input in the Food Processing/ Technology/Storage areas. Since LAC draws heavily on the staff resources of the Research Station, there is an indication for a processing specialist to be included in the plans for developing a laboratory facility for food analysis and testing.

5.8 Basotho Fruit and Vegetable Canners

Person contacted:

Ms S E Lethunya, Administration Manager

Basotho Canners is a subsidiary of LNDC, and is engaged in the production mainly of canned asparagus for the export market and smaller quantities of other canned products such as canned green and baked beans. The field production (of raw materials), processing and quality control staff have appropriate basic training but further training is being planned or is current.

The agronomist has a degree in Agriculture and, besides production aspects of the crop, supervises and maintains quality at and after harvest.

The production manager is currently undergoing training in UK in an MSc Food Science programme at the University of Reading and training is being actively explored for the quality controller, who has a basic degree in Chemistry but needs strengthening in the areas of microbiology, quality control, instrumentation and food analysis.

The production supervisor, who is currently filling in for the production manager, also has considerable on-the-job training but is enthusiastic for further specific training in food technology.

The project has expansion plans and recently submitted a proposal for expanding present capacity to SADCC. The initial reaction to review of the proposal has been a request that expansion be based on product diversification to maximally utilize production capacity on a year-round basis. The enterprise shows potential for developing a good domestic and export market judging from the present level of organization and product quality. However resources/funding for strengthening its technical manpower are an essential prerequisite. An essential component of the team, now lacking, is seen to be a process/mechanical engineer.

6 ANGOLA

Persons contacted:

Mr Joao Paulo, Agricultural Economist
Ministry of Agriculture

Mr Carlos Souza, Agronomist
Augustino Neto University, Faculty of Agriculture

6.1 Augustino Neto University, Faculty of Agriculture

Two degree programmes are offered in the University, viz. BSc Agriculture and BVSc.

The Agriculture degree programme includes a four- to six-month (semester) course within the Agronomy course which has a component of post-harvest processing of agricultural produce (mainly vegetables) and storage. However even this component is faced with many constraints of inadequate manpower to teach these post-harvest disciplines.

Due to lack of local expertise in these disciplines, the course has hitherto been taught largely by expatriate staff from countries such as Bolivia, Belgium and Vietnam. The Faculty staff consists of about 35 local staff trained at BSc level, none of whom have any post-graduate training or qualifications.

In the past (1970-1975) a full five-year BSc Food Technology programme was on offer but due to severe staff constraints the programme was now defunct. However basic food analysis laboratory facilities exist, though lack of adequately trained technical staff (technicians) and resources hamper the use of these laboratories for teaching or research.

University admission requires 13 years of formal education, i.e. 9 years of school and 4 years at Polytechnic. A diploma is awarded at the end of four years of the Polytechnic as a middle level qualification, and four further years would lead to the BSc Agriculture degree. Total enrolment at the Agriculture Faculty is about 350 students with about 10 students graduating each year in Animal and Crop Sciences.

The Veterinary Department within the Faculty of Agriculture has two staff members with Animal Nutrition and Food background and it is also called upon to assist with meat inspection services since adequate numbers of veterinarians are not available to man the Public Health and Veterinary services.

6.2 Agriculture Colleges

6.2.1 Instituto Medio Agrario, at Hojy-ya-Henda

6.2.2 Instituto Medio Agrario, at Tchivinguiro

A third college is currently non-functional for lack of resources and staff.

The agriculture colleges offer certificate and diploma level training in agriculture, for candidates with 6 and 9 years of formal school respectively. The certificate level course is a two-year course, while the diploma is a four-year training.

6.3

Other field, extension and farmer training opportunities have been disrupted by the war and are not currently available.

6.4

The major food industry is the brewery; others such as milling and canning are grossly underdeveloped or non-existent.

6.5

Import, handling and marketing of grain is handled through the Ministry of Trade which is also responsible for purchase and marketing of local produce. But like all the other institutions and organizations it suffers from a lack of trained personnel in areas of marketing and storage and a lack of training opportunities.

Arising from the protracted war situation in Angola the resource base (human, facilities, equipment) and infrastructure are so badly eroded that Angola needs massive injections of rehabilitation efforts not only in the post-production areas but in all sectors of the economy. The establishment of links with regional training institutions and universities is recommended as an immediate measure that is feasible within the SADCC objectives and mandate. It is understood that initiatives for training of veterinarians and supply of support staff have already commenced with the University of Zimbabwe. Such training activities could be developed at all levels with parastatal and industrial training programmes. An

essential prerequisite, however, is the availability of an English language preparatory course, through an intensive language laboratory system, to enable selected candidates to benefit from training and instruction in the Anglophone countries of the region.

7 TANZANIA

7.1 Ministry of Agriculture and Livestock Development

7.1.1

Person contacted:

Mr G Mrema, Crop Production and Extension Services, and Food and Nutrition Division

Training programmes under this unit are conducted at Uyole and Ilonga Agriculture Institutes, which offer a two-year diploma programme in Food Production and Nutrition. The curriculum covers areas of post-harvest processing and technology, including food storage, and food processing. The two colleges at Uyole and Ilonga graduate about 30 and 20 diplomates respectively each year. The Food and Nutrition Unit of the Ministry of Agriculture absorbs most of these diplomates.

The Food and Nutrition Division of the Ministry is administered by:

Mrs J Ishengoma
Mr G Mrema
and Mrs S Lueno

all of whom hold post-graduate diplomas in Food and Nutrition. About 15-20 Food Science and Technology graduates from Sokoine University join the Unit each year.

Field staff of the Unit such as the Regional Agriculture District Co-ordinators, numbering 20 (one per region), and the District Co-ordinators, 75 per district, receive training on the job through specific sponsored projects such as the UNICEF Household and Child Survival project, supplemented by seminars, training workshops, and short courses abroad such as the ECSA Food and Nutrition course held in Zimbabwe each year.

Arrangements are on-stream for a candidate to go to Zimbabwe and another to the International Agriculture Centre in the Netherlands for training and for Mr Mrema to proceed to the Netherlands for a post-graduate diploma in Food and Nutrition. Funding for conducting a two-month in-country training programme for 30 diplomates is being

explored with co-operating institutions in Holland to provide the trainers. There are 250-300 diploma holders with specialisations in Food and Nutrition in the country.

Projects such as the proposed UN/FAO/WHO project on National Vitamin A Deficiency Control, incorporating a substantial training component over a ten-year period, are also expected to provide significant inputs into the training effort. Other such projects are:

- The Norad-supported Rukwa Development Programme (RUDEP)
- EEC proposal for a Food Production and Nutrition programme
- GTZ-funded, Tanga Integrated Rural Development project (TIRDEP) providing food and nutrition and horticulture training for extension workers.

7.1.2 Training Division, Ministry of Agriculture and Livestock Development

Person contacted:

Mr R Rwasa, Chief Training Officer

Fifteen training institutes in Tanzania, including two fisheries training centres, provide training up to certificate (Junior School Certificate plus two years) and diploma (School Leaving Certificate plus two years) levels. All of these training programmes include a strong component of the post-harvest disciplines (agricultural produce handling, storage and processing) in the curriculum but the strongest programmes are at:

- Tengeru Horticulture Research and Training Institute
- Ilonga Training Institute, Kilosa
- Uyole Agriculture Centre, Mbeya
- Ministry of Agriculture Training Institute, Ukirimuri Mwanza

The Food Science and Technology (FS & T) components are taught by FS & T graduates from Sokoine University including one MSc (FS & T) at Uyole.

Besides the institutional training programme, short 6-8 week courses are run for extension staff and special courses in plant protection and post-harvest aspects of crop production.

7.2 Small Industry Development Organization (SIDO)

Person contacted:

Mr E B Toroka, General Manager

SIDO is involved with the development and promotion of several small-scale food processing projects. These include: maize milling, animal feed manufacture, bakery, fruit and vegetable preservation, juice and edible oil extraction, and small grain dehulling.

SIDO food processing units are located at Tanga, Arusha, Morogoro and Dar-es-Salaam. Three units serve as demonstration, training and service centres. SIDO technical staff consist of:

Mr Limbe - food processing engineer

Mr Lysen - research and planning officer

Mr R Mollel - mechanical engineer (currently studying for diploma in mechanical engineering)

Mr Gonelimali, a second mechanical engineer, has been identified for overseas training in food processing (with emphasis on cereals and vegetable oils) and sources of funding are being explored.

SIDO has regional representation in the twenty regions, each region having one regional manager, one technical officer and one economist.

SIDO training functions have been geared to the needs of small entrepreneurs and have been directed mainly at this clientele.

A course for dehuller operators has been run by Mr Limbe and two technicians for machine operators. These courses at the same time provide training for the SIDO regional technical officers. For example at Kilosa (Morogoro) twenty regional officers received training in dehuller technology. The Kilosa vegetable oil project is also served by a process engineer (BSc Engineering) and one project manager.

SIDO wishes to strengthen its technical capabilities with more specialized training for its staff. Silsoe College, UK, has accepted two candidates for a post-graduate diploma course in Crop Storage and Processing, but funding is a constraint.

7.3 National Milling Corporation (NMC)

Persons contacted:

Mr Mollel, General Manager

Mr V Semesi, Director of Milling

Mr Msumi, Training Manager

Mr Rubibira, Training Officer

NMC is a parastatal organization engaged in several activities related to procurement, storage and processing of a range of food products. These activities include grain storage, canning, brewing, milling, baking, animal feeds and weaning food manufacture.

7.3.1 Storage, Quality Control and Pest Management

Post-harvest grain losses have increased significantly over recent years due to the Larger Grain Borer infestation. The alarmingly rapid spread of the pest in Tanzania is of grave concern, and therefore pest control and grain management are areas of urgent and high priority. The recent FAO Food Security Mission has recommended a strategic grain reserve of 100 000 tonnes. NMC grain storage capacity is about 529 900 yet grain stores and silos are managed by store assistants with inadequate storage and grain management skills.

The training programme within NMC has three major components:

i) in-country, in-house training for new and existing staff (refresher courses);

ii) World Bank funded programme to support training at all levels, including storage and milling (in-country and overseas);

iii) Australian Regional Grain Management Project, providing certificate and diploma level training using a distance education strategy, whereby the candidates will study in-country and qualify for a certificate in grain husbandry by 1990. Under the Australian programme three depot staff are to be trained. Six Australian tutors will supervise and run the programme regionally.

Under the World Bank project about 300 trainees are to benefit in several areas including accounting and management, at all levels (Table 7). Pest control trainees are already on training at the national institutes at Tengeru, Uyole and Ilonga and at Sokoine University, while

others are being sent to ODNRI, UK. Broadly the programme comprises:

- training in Tanzania with assistance from FAO/ODNRI training staff plus NMC staff already trained by ODNRI;
- a period of subsequent field work and assessment at NMC; and
- a further tailor-made programme for selected trainees from the earlier programme at ODNRI (four candidates completed pest control training at ODNRI).

(Source: Grain Storage and Milling Project, D R Brevin, 1987)

There is need for refresher courses in grading and quality control.

Table 7: Summary of training programme for NMC staff including pest control

Type of training	Participants	No.	Venue	Duration	Required Action
1. Management training	Directors, B/Ms and heads of departments at head office and branch level	90	Abroad	1-2 months	1. Preparation of individual training profiles so as to do direct training to the specific needs of NMC. 2. Choice of a management training agency to conduct the training. 3. Drawing of tailor-made programme for each group.
2. Supervisory training	Quality and pest control officers, stores and transport officer and technical supervisors including shift millers	75	Abroad	1-2 months	As above
3. Milling training	Millers	12	Henry Simon (UK)	3 months	Selection of trainees
4. Specialised milling training for senior personnel	Senior milling personnel	6	" "	2 months	Setting of tentative dates
5. Storage of durable agricultural products in the tropics	Quality and pest control staff	40	Local	3 weeks	Selection of trainees
		10	ODNRI (UK)	6 weeks	1. Negotiation with TDRI 2. Selection of trainees
6. Financial training	Lower accounting cadre	12 per yr	In-house	1 month	Selection of trainees
7. Training of trainers course	Training staff	1	UK	4 months	Confirmation with training institute
8. Training in management Training for supervisors	Training staff	1	Abroad	not identified	Awaits agreement with a management consultancy firm
9. Workshop training	Not identified				Awaits decision of future policy regarding repairing of vehicles
10. Executive development programme	Director General	1	Abroad	1 month	

(continued)

Type of training	Participants	No.	Venue	Duration	Required Action
11. Personnel management	Personnel and administrative manager	1	UK	24 months	Awaits confirmation on training institute
12. Planning and operations	Head of planning and operations	1	UK	18 months	Awaits confirmation on training institute
13. Food microbiology	Laboratory staff	2	ODNRI (UK)	4 months	Communication with ODNRI
14. International negotiations, bidding, etc.	Legal secretary	1	Rome	3 months	Communication with training institute
15. Bakery technology (maintenance and quality control training)	Bakery staff	2	Rank Hovis (UK)	not identified	Awaits confirmation
16. Baby food technology	Baby food nutritionist	1	not identified	not identified	Awaits communication with firm

Source: Brewin, 1987

7.3.2 Canning and brewing

The NMC cannery is engaged in processing of fruits and vegetables and employs two food technologists (Sokoine University graduates). The brewery located in Dodoma is essentially a winery, producing fruit wines and employs a graduate enologist. Some personnel were trained in Italy in 1978 but refresher training is indicated. Short-term training and attachments for personnel in wineries in Zimbabwe have been requested.

7.3.3 Milling

There do not appear to be manpower constraints in milling technology. Several millers (about twenty) have been trained in Germany, Switzerland and UK. A recent training review document (Brevin, 1987) has however indicated training needs for six senior milling personnel and for twelve additional trainee millers for periods of six and twelve months respectively in milling industries in UK. While a six month training for already-in-service senior millers seems appropriate, the proposed twelve month training for new recruits is totally inadequate and incompatible with the usual 4-6 year training period required by international and regional (Blue Ribbon Foods Zimbabwe) milling schools.

NMC manpower status in the post-production fields and requirements are summarized in Table 8.

7.3.4 Baking

NMC has one fully trained (in UK) baker and six others who have attended a six-month course in Canada. While it is felt that these bakers would benefit from short overseas refresher courses, the training needs review has identified a need for two candidates to be trained in Bakery Technology (Maintenance and Quality Control), probably with Rank Hovis in UK.

7.3.5 Animal Feed and Baby Foods

The stockfeeds division of NMC has one animal nutritionist who also assists with the baby food processing (formulation). The latter activity is also supported by the millers and bakers and a nutritionist graduated from the Agriculture Training Centre at Uyole. However, the services of a food technologist are an immediate need in this division. The recommendation of the training review document for a baby food nutritionist rather than a food technologist will need to be reviewed and reconsidered.

Table 8: NMC manpower positions/requirements 1985-86 and 1987-88

Post	Total establishments	Requirements 85/86	86/87	87/88
Quality and pest control officer I	1	1	1	1
Quality and pest control officer II	1	1	1	1
Quality and pest control officer	10	10	10	10
Assistant quality and pest control officer	14	14	14	14
Quality and pest control assistant	22	22	22	22
Silo technician	5	5	5	5
Chief chemist	1	1	1	1
Laboratory technician	2	2	2	2
MILLING Director milling	1	1	1	1
ENGINEERING Chief) Electrical)	4	4	4	4
Mechanical)				
? Professional				
Technicians: Mechanical) Electricians)	37	37	37	37
Charge hands) Maintenance)				
Head milling	4	4	4	4
Milling	14	14	14	14
Trainee millers	9	9	9	9
Production supervisors	2	2	2	2
Quality control	1	1	1	1
Plant operators	62	62	78	78

Source: Brevin, 1987

7.4 Tanzania Food and Nutrition Centre (TFNC)

Persons contacted:

Mr M K Kepakepa, Head
Food Science and Technology Department

Mrs Misano, Principal Training Officer

TFNC is a parastatal organization. Among its diverse functions it is responsible for:

- providing facilities for training in subjects relating to food and nutrition and prescribing conditions which must be satisfied before a diploma, certificate or other award may be granted in any such subject upon completion of any such training undertaken by the Centre or other educational institution in Tanzania;

- carrying out research in matters relating to food and nutrition;

TFNC comprises six departments, viz:

- Finance and Administration
- Planning
- Medical Nutrition
- Food Science and Technology
- Nutrition and Education Training
- Laboratory Services.

The Food Science and Technology Division consists of three divisions:

- Food Technology
- Food Economics
- Food Science.

Current staff strengths in the Food Science and Technology areas are represented in Table 9.

Table 9: Staffing at TFNC in Food Science and Technology

Mr C R Temalilwa	-	MSc (Food Science Technology) 1981, currently in US for PhD
Mr W S Lorri	-	MSc (Food Technology) 1983, currently on PhD training
Mr V M Kepakepa	-	MSc (Food Science and Applied Microbiology)
Mr H H Basheke	-	MSc (Food Technology) 1985
Mr E E Nyangali	-	BSc (Food Science and Technology) 1985)
Mr G T Ndunguru	-	MSc (Food Science and Technology) 1986
Mrs R Kingamkono	-	MSc (Human Nutrition) Postgraduate Diploma (Food Science and Nutrition)
Mrs P N Kingamkono	-	Postgraduate Diploma (Food Science and Nutrition)
Mrs H H Missano	-	Postgraduate Diploma (Food Science)
Mrs S Malekela	-	Postgraduate (Food Science and Nutrition) 1979
Mrs A Bakart	-	Postgraduate (Food Science and Nutrition) 1982
Mrs H Materu	-	Postgraduate (Food Science and Nutrition) 1984
Mr N Su-Kalinga	-	MSc (Food Science and Human Nutrition) 1986
Mr N L Mlingi	-	Msc (Food Science and Human Nutrition) Postgraduate Diploma (Chemistry)
Miss H Hakimjee	-	BSc (Microbiology)

Source: TFNC staff list

TFNC activities in the area of food-related training, services and research cover a wide spectrum. These include:

- liaising with the National Food Commission on the implementation of the Food (Control of Quality) Act and food standards;
- liaising with the Tanzania Food Manufacture Association;
- weaning foods processing and promotion;
- extruded baby foods;
- composite flour
- food composition.

TFNC facilities include a food and nutrition laboratory and microbiology laboratory.

It is proposed to conduct a national manpower needs assessment survey as a basis for developing a Food and Nutrition School within the next five-year plan period. The school is intended to provide short courses locally, using local manpower resources. Tanzania has been sending two to five candidates for training at the ECSA Food and Nutrition courses each year and it is hoped this training need will be met locally by the proposed school.

7.5 University of Dar-es-Salaam and Sokoine University of Agriculture

7.5.1 Institute of Production Innovation (IPI): Affiliated to University of Dar-es-Salaam

Persons contacted:

Mr Jan Jasper, Head of IPI (Economist)

Mr Kuwamba, Deputy Technical Manager

IPI was established in May 1979 as an autonomous Institute of the University of Dar-es-Salaam and funded by means of a bilateral agreement between the Federal Republic of Germany and Government of Tanzania. The main objectives of IPI are:

- product and technology innovation and transfer;
- consultancy services to industry; and
- curriculum advice to Faculty of Engineering relating to needs of industry.

IPI staff involved in technology development are largely engineers and consist of one refrigeration engineer, working on solar refrigeration systems, and two chemical process engineers, one of whom is currently on training in Canada and one involved with food processing. A short-term consultant engineer from the University of Reading is currently advising and training staff in computer use and fuel alcohol technology. Food processing projects include:

- development and design of edible oil processing equipment;
- food drying;
- evaluation of maize shelters; and
- small-scale sugar processing.

With the range of interests in and inputs into food processing, represented by these projects, the incorporation of a food technologist in the engineering team is essential, since equipment design and development must go hand in hand with process optimization and product quality. The food technologist input is also an essential component of the IPI's user and operator training programme and 1-2 week training courses conducted for entrepreneurs and buyers of equipment.

7.5.2 Sokoine University of Agriculture

Persons contacted:

Mr Ilupanga, Associate Dean and Head of Agricultural Extension

Dr N Bangu, Food Scientist, Head Department of Food Science and Technology

Dr E Maeda, Lecturer (Food Scientist)

Dr H Dihenga, Engineer, Department of Agricultural Engineering and Land Planning

Mr Kajuna, Engineer, Department of Agricultural Engineering and Land Planning

7.5.2.1 Department of Food Science and Technology

The Department of Food Science and Technology offers two degree programmes, viz. in Home Economics and Human Nutrition, and in Food Science and Technology. The Department also offers service courses in Food Processing

and Food Science to the BSc Agriculture and Agriculture Engineering programmes.

Up to 1979 Food Science was an option in the BSc Agriculture programme. Since 1984 a full four-year BSc Food Science and Technology programme has been on offer, producing 15-20 graduates per year. The Department is well staffed in both technician and academic grades of staff with several staff development candidates currently completing MSc and PhD programmes overseas. The academic staff breakdown by sub-disciplines is as follows:

Food Microbiology	1
Food Chemistry/Biochemistry	2
Food Processing/Manufacture	4
Process Engineering (complemented by Dept. of Agric. Engineering)	2
Food Quality Control	1
Total	10

Source: Food Science and Technology, staff list, Sokoine University

Support technical staff consist of:

2 food technology technicians, trained to diploma level in UK

1 technician, trained to certificate level in UK

1 technician, Dar-es-Salaam Technical College; Food Technology Certificate, supplemented by short course in Kenya

Technicians also receive short training on specialist courses; 2 technicians have been on such training on 6-month courses in Norway.

The Department of Food Science is in the process of completing their new laboratory facility, which will be equipped with funding from ODA.

All these programmes are being planned in conjunction with the University of Reading and this project includes a training component with funding for a 12 man-year staff development and PhD training programme.

7.5.2.2 BSc Agriculture Programme

The programme is well served with inputs of teaching in the post-production (PP) discipline, storage, marketing/economics and processing. The breakdown of course components in Table 10 represents the range and content of post-production inputs in the BSc Agriculture programme.

Table 10: Post-production components in BSc. Agric. curriculum at Sokoine University

Year	Course	Hours	Examples of PP content
1	Agriculture Biochemistry	60	
	Principles of Agronomy	35	Harvesting, storage, processing and marketing of annual crops
2	Agricultural Processing	18	
	Food Processing and Preservation	35	
	Animal Products	10	Handling, processing, preservation and utilization of livestock products, milk, cheese, butter, ghee, fish, meat
3	Crop Handling, Processing and Storage	45	
	Rural Structures and Services	45	
	Agricultural Marketing	30	
	Horticulture	70	Harvesting, processing and marketing of horticulture crops
	Plantation crops	30	Harvesting, processing and marketing of plantation crops

7.5.2.3 Department of Agricultural Engineering and Land Planning

Of a total academic staff strength of 22, 4 staff are involved with teaching of post-production components in the BSc Agricultural Engineering programme (one of whom is a process engineer) and in post-production/processing research. Current interests in processing projects include:

- damage of produce during transport;
- oilseeds processing (collaboration with IPI);
- palm oil processing; and
- rural structures and storage.

The department has an annual intake of 20 students per year and an annual graduation rate of about 16. Student projects on crop (primary) processing include design and testing of maize shellers, winnowers, etc.

Some post-production components of the BSc Agricultural Engineering curriculum are reflected in Table 11 to illustrate level of incorporation of the post-production disciplines.

Table 11: Post-production components in BSc Agric. Engineering curriculum at Sokoine University

Year	Course	Hours	Example of Post-production content
3	Agric. Process Engineering I	117	Cleaning and grading; pneumatic and centrifugal separation; decortication, filtration, expression, size, reduction mixing; application to processing of oilseeds, animal products
	Principles of Agriculture	135	Plant protection, stored pests, pest control
	Food Microbiology	42	Bacteria yeasts and fungi in relation to food; drying; fermentation; single cell proteins in food engineering
4	Agric. Process Engineering II	117	Theory and application of thermal unit operation; drying, evaporation, freezing, etc; application in processing of cereals, oilseeds, tea, coffee, milk, etc.; storage of agricultural produce; produce packaging; materials handling
4	Agric. Process Engineering III	90	Advanced treatment of unit operations used in crop and food processing; bio-engineering, fermentation

7.6 Food and Agriculture Organisation (FAO), Larger Grain Borer (LGB) Project

Person contacted:

Mr V Ndibalema, Acting Training Manager

A three-year programme for LGB control was initiated between FAO and the Ministry of Agriculture and Livestock Development in 1984. This project was also supported by a three-month bilateral assistance programme funded by UK. Both field and extension officers of the Ministry of Agriculture as well as the diplomates and certificate holders from the Agriculture Training Institutes lacked storage and post-harvest knowledge and an intensive training programme for all cadres involved in field control as well as in training was seen as an urgent need.

The training programme catered for different levels of staff.

2 weeks course for Regional Agricultural Development Officers (RADOs)

4 weeks course for Regional Produce and District Inspectors

6 weeks course for Mobile Pest Control leaders

2 weeks course for Ministry of Agriculture Training Institute (MATI) tutors

Over the last two and a half years, 25 courses have been run and 447 persons have received training (Table 12).

Besides the Ministry staff several courses were offered for warehouse and co-operative personnel, totalling 126.

1 x 1 week course to Tanzania Seed Corporation

1 x 1 week curse to Tanzania Seed Certification Agency

1 x 1 week course to VSO

The project also sponsored several candidates for short six-month training courses in grain storage and handling abroad at ODNRI and other centres. In 1988, two officers underwent training at ODNRI and a further two officers received training at IITA (Nigeria). The project has supported one MSc in the Technology of Crop Protection and one postgraduate Diploma in Extension Methods at the University of Reading. Two officers are to receive special training in Phytosanitation at the University of Reading.

Once the full component of staff has been trained and the local training capacity established, the post-harvest grain storage training programme should be a continuous activity at all levels.

Table 12: List of courses held by FAO/LGB Project

Title of Course/Seminar	Number of courses held	Number of participants
Storage seminars for District Agricultural Development Officers	6	100
Storage Management course for personnel for village storage	3	105
Course for Post-Harvest Officers Western Tanzania and VSO	3	48
Course for Mobile Pest Control Team Leaders and Fumigators	3	28
Short course for untrained Produce Inspectors	1	21
Short course for Pest Control personnel for Zanzibar and Pemba	2	39
Produce Inspectors four weeks qualifying course	3	66
Course for Armyworm and Quelea Control	1	11
Field training of Pest Control personnel (experimental)	1	3
Course for Tanzania Seed Company and Tanzania Organisation for Seed Certification	2	18
Course for VSO	1	8
Total		447

Source: Ndibalema V.R.J. and M... for Improv... Borer

8 ZAMBIA

8.1 University of Zambia (UNZA), School of Agricultural Sciences

Persons contacted:

Dr G Chibilito, Head of Crop Science Department

Dr Y Deedat, Entomologist

Dr Javaid, Pathologist

The University of Zambia BSc Agriculture degree is a five-year programme. The programme incorporates a 14-week module on post-harvest technology, taught in two parts of seven weeks each, on:

i) storage and handling of perishables, and

ii) processing of fruit and vegetables.

Dr Chibilito and one other in the department have specialist training in horticulture and post-harvest areas. Another staff member with MSc in post-harvest technology is now at the University of Manitoba pursuing a PhD in Food Technology.

The crop protection course provides some coverage on storage pests but the course is generally weak in storage. Most other courses, including the Animal Science courses, are mainly production oriented. The Agricultural Engineering course also covers storage to some extent.

The Faculty produces about 50 graduates per year and on average 6-10 students take the optional course in post-harvest technology every year. The course has been running for the past three years and has provision also for undergraduate projects to be undertaken in this area. However no students have opted for post-production projects to date.

A proposal for a Food Science degree programme had been under discussion for some years and currently a Committee has been appointed to carry out needs assessment study to assess present and potential manpower needs in this discipline. The Committee has visited the Food Technology programme in the region at the University of Nairobi and of Sokoine in Tanzania.

8.1.2 University of Zambia, Technology Development and Advisory Unit (TDAU)

Person contacted:

Dr A Lemmens, Head of Unit

The TDAU of UNZA was formally established in January 1975 as an adjunct of the School of Engineering. The objectives of TDAU are primarily focused on the development and improvement of designs, processes and equipment to serve local industries and rural needs. The work of the Unit is strongly engineering-geared and accordingly most of the 12 technical staff are trained in engineering disciplines, except those in Documentation and Extension.

However, two of the current projects are in areas of food processing, viz. oil extraction and sorghum dehulling. Other food crop processing projects include development of a maize and peanut sheller. Such projects admittedly need advisory inputs of a food technologist.

Development and sale of adapted technology, such as the oil extraction press, include a training component for customers, in the package, consisting usually of a one-week course on principles and practice of operation and processing, machine maintenance and book-keeping, at time of sale, followed by a refresher course one year later.

TDAU is still dependent on inputs of expertise from expatriates and technical aid programmes (Royal Tropical Institute, Netherlands, and Eindhoven University of Technology), but expects to be fully localized in one and a half to two years.

8.2 Food and Nutrition Commission

Persons contacted:

Mr P Chipuki, Acting Executive Director

Ms M Mulunga, Nutritionist

The Food and Nutrition Commission was established in 1967, with a mandate to address issues of nutrition training, research, and extension, food and nutrition policy, and co-ordination of nutrition with food production and rural development. The five divisions of the Commission are:

- Communications Unit
- Nutrition Education Unit
- Public Health Nutrition

- Food Science and Technology, and
- Policy Planning Unit.

Of the establishment of 16 professional positions only 11 professional posts are currently filled, eight of which are occupied by nutritionists and one food scientist (MSc). The nutritionists consist of one MSc in nutrition, while the rest are diplomates of the Natural Resources Development College, or BSc graduates from UNZA. The diplomates are upgraded through short-courses, e.g. ECSA Food and Nutrition Course, Zimbabwe.

The Food Science unit is staffed by one MSc Food Science (Head of Unit) and two diplomates. The Commission is grossly understaffed due to lack of qualified personnel and lack of funding for scholarships and further training. Projects initiated under the Food Technology Unit include:

- food storage and handling
- utilization of traditional vegetables
- food composition tables, and
- solar drying.

However lack of staff and laboratory facilities hamper the progress of these projects.

8.3 National Milling Company

Person contacted:

Mr J Chulu, General Manager

NMC is a government-owned operation, under INDECO (Industrial Development Corporation). INDECO also administers three other smaller milling operations. Indeco Milling Company in Ndola, Chana Milling Company and United Milling Company in Chingola. Three other private millers in Lusaka have now been nationalized and the milling industry in Zambia is now completely state-owned.

Milling operations include maize, wheat milling and animal feeds manufacture. Millers are trained through an in-house training programme of six years, accredited by a milling school in the UK. The current milling cadre consists of 36 qualified millers and six in training. The position of mill manager, held by a British expatriate, is expected to be localized in the next 3-4 years. Three expatriate millers have been provided by Danida to service the Danida-funded maize plant in Livingstone and the new mill in Kabwe.

The established technical posts for the stockfeeds division consist of one post of nutritionist (currently vacant and a replacement being sought with PhD) and post of chief chemist (BSc), supported by laboratory technicians and other production staff with NRDC Animal Husbandry diplomas. These staff also receive short-term training abroad. The manpower deficit at NMC and the milling industry appears to be in the management, finance and accounting areas rather than in processing and production.

8.4 National Agricultural Marketing Board (NAMBoard)

Persons contacted:

Mr A Kani, Commercial Manager

Mr J Chirwa, Storage Manager

Since Zambia has not been a grain surplus country, manpower development in grain storage and management had received low priority in the past. Therefore pest control and management skills are scarce. NAMBoard operates 6 silo complexes, located in Monze, Lusaka, Chisamba, Nutuseko, Ndola and Kitwe, and about a thousand grain depots (including those of the Ministry of Co-operatives). Currently only three pest-control teams are available to service the 9 provinces with one unit to 3 provinces, while the ideal requirement is one unit per province. Each team has at least one trained specialist, usually BSc or diplomate with entomology specialization. Team leaders have also been on the ODNRI short courses on pest control and management. More candidates have been identified for the ODNRI course but funds are a limitation. The technical cadre currently consists of:

1 Senior Pest Control Officer, MSc Agric. Engineering, with storage specialization

3 Regional Pest Controllers, BSc - Diploma levels

3 Pest Control Officers

and several pest control assistants.

NAMBoard is planning to intensify their training capacity, through establishment of their own training centre (funded by Canadian Aid) and buildings are already under construction. Meanwhile an in-house training programme has commenced under Mr Chirwa, the storage manager, assisted by the regional pest controllers.

Zambia is also already included under the Australian Regional Training Project under which training needs have been identified.

8.5 Ministry of Co-operatives

Person contacted:

Dr M Subrahmanyam, FAO consultant

The Provincial Co-operative Units, functioning under the Ministry of Co-operatives, are responsible for the collection and short/medium-term storage of grain, since the role of the NAMBoard has now been expanded to that of maintaining the strategic grain reserves. The Provincial Co-operative Units are lacking the physical and manpower resources to cope with this responsibility since the grain management services available at NAMBoard are hardly adequate to meet the NAMBoard responsibilities. Up to last year the Provincial Co-operative Units were merely acting as purchasing agents for NAMBoard and purchases of grain were handed over directly to NAMBoard. The Ministry of Co-operatives' grain storage capacity is about 1.3 million tonnes, of which 696 000 tonnes are held on hardstands. 60% of the hardstands are on wooden poles, and stacks are not covered by polythene or tarpaulin. Hence losses are considerable. Handling practices compound these losses. Only limited facilities are available for pesticide application and fumigation and trained staff are available only in 5 of the 9 provincial headquarters.

The only facility with present training capacity for provincial staff is the Food Conservation and Storage Unit at Mount Makulu. The existing Co-operative Training College has never included storage and marketing in its programme.

Since storage and marketing have now become a primary function of the Ministry of Co-operatives, these aspects of training should receive priority attention in the curriculum, and funding should be explored for strengthening training either through NAMBoard's expanded training programme or through development of the Co-operative College facilities and resources.

8.6 Food Conservation and Storage Unit, Mount Makulu Research Station, Ministry of Agriculture

Persons contacted:

Mrs M Zulu, Storage Training Officer

Mr J Mlimo, Storage Extension Training Officer

The unit consists of 5 sub-sections but only 4 are operational, viz.

- Entomology: grain quality analysis, pest identification, research and control;

- Storage Engineering: design of structures for small-scale farmers; promotion and improvement of traditional structures;

- Storage Chemistry: analysis of pesticide residues; research and testing of new pesticides;

- Storage Training and Extension: training workshops and short-courses for extension workers;

- Storage of Perishables: non-functional.

Staffing in the 4 units is as follows:

Entomology	- 1 PhD seconded to FAO - 1 BSc (UNZA) - 1 diplomate (NRDC) - 2 laboratory assistants (school-leavers
Storage	- 1 Diploma (NRDC) - 1 Senior Agricultural Assistant (Certificate) - 2 general workers
Chemistry	- 1 Diploma (to receive training in UK for MSc) - 1 Senior Agricultural Assistant (Certificate) - 1 general worker
Extension & Training Engineering	- 1 BSc - 1 Diploma - 2 field staff (1 Diploma, 1 Certificate)

Several of the above staff have been on short-term training programmes abroad, at Kansas State University, ODNRI and IITA. With this training exposure, and their on-the-job experience, the staff resources of the Food Conservation and Storage Unit could be mobilized into expanded training activities to serve the immediate and urgent needs of the Ministry of Co-operatives as well as to supplement NAMBoard's in-house training efforts. The training activities of the Unit and Extension and Training Division in particular are very limited, due to financial constraints.

8.7 Natural Resources Development College (NRDC)

Person contacted:

Mr D H McCleery, Vice-Principal

The College awards a 3-year Diploma in Agriculture with majors in Crop Science, Animal Science, Agricultural Business Management, Agricultural Education, Agricultural Engineering, Nutrition and Water Engineering. Basic entry requirements are Grade 12 for direct entry, with in-service requirements for mature-age students. A credit in Mathematics and at least two physical science subjects are a direct entry requirement for all courses, except for Agricultural Business Management. The college graduates about 60 students in General Agriculture, 50 in Agricultural Education, 30 in Nutrition, 18 in Agricultural Engineering and 18 in Water Engineering, per year. The component of post-production courses in the curriculum is low and is limited to:

- harvesting, threshing, storage and marketing, grain pests and control, in the Crop Science option;
- food storage and preservation, rural and urban; modern food technology, quality control and legislation, food composition, food processing, in the Nutrition option; and
- meat inspection, in the Animal Production option.

8.8 National Council of Scientific Research (NCSR)

Person contacted:

Mr J Mwale, Head, Food Technology Resource Unit

A Food Technology Research Unit (FTRU) is a component of the research facilities of NCSR. The FTRU is equipped with a foods analysis laboratory, a cereal laboratory and a small pilot plant. The Head of Unit, Mr Joseph Mwale, holds MSc in Food Science. The Unit was earlier manned by three food scientists and two technicians with NRDC training and certification. One position of food scientist has been vacant since the departure of Mr Dapah (an expatriate) who had served in the Unit for about six years, and this vacancy is in the process of being filled.

The Unit has been engaged in contract research for industry, mainly in the area of fruit and vegetable processing. However, a project document had been prepared for development of a cereal technology laboratory and been submitted to EEC for funding. One trainee was presently overseas on a cereal technology training programme and will provide the nucleus of the proposed cereal laboratory.

9 ZIMBABWE

9.1 Agriculture and Rural Development Authority (ARDA)

Person contacted:

Mr Emmanuel Nzuzu, Chief Training Officer

ARDA was originally engaged only in agriculture production schemes of its own or in rural development projects. It has several production projects of its own, producing cotton, wheat, beans, horticulture crops, tea, coffee, beef and milk. While most of the produce of ARDA estates goes through existing marketing and processing channels (GMB, CSC, DMB and CMB), ARDA has developed its own processing plants for tea and is expecting to set up a cannery for its horticulture produce. The tea processing plant at Katiyo has a continuous in-house training programme; however, local capacity does not exist for training in the more specialized aspects of tea processing and quality control, for which ARDA is dependent on external training.

Long-term plans for a horticulture development programme of production and processing have already been initiated and Manicaland and Mutoko have been identified as project areas. ARDA is in the process of recruiting a horticulture processing specialist who will develop a proposal detailing technical needs and personnel.

9.2 Department of Agricultural, Technical and Extension Services (AGRITEX), Ministry of Lands, Agriculture and Rural Resettlement

Person contacted:

Mr D Ford, Assistant Chief Training Officer

The Training Branch services the Crop Production, Planning, Irrigation, Engineering and Animal Production Branches within the Department of Agritex. Course and curricula development is done by specialists and commodity experts in the different branches, while training and teaching aids are produced by the Training Branch. The training of extension personnel is biased towards agricultural production and planning. Post-production is a neglected area and needs to be addressed in the future. No specialist expertise in post-production exists in the Department.

9.3 Harare Polytechnic

Person contacted:

Mr C Muzariri, Head of Department of Science and Technology

The Polytechnic offers a recently-mounted Bachelor of Technology degree (BTech) programme. The first group of BTech students are currently in their third year and are due to complete their four years honours degree by December 1989. The BTech degree option was introduced to meet development and production needs of biologically-based industries with a major emphasis on food and food-related industries.

The BTech programme specialization options are:

- Applied Physics
- Applied Chemistry and Chemical Technology
- Applied Biology and Biochemistry.

The first year of the programme covers basic physical and biological science common courses and specializations commence in the second year. It was claimed that up to one-third of the Applied Biology and Biochemistry degree consists of Food Science and Technology and food-related courses; however, the course content of these courses was not available. It is also claimed that there is a good complement of qualified staff, of whom two are qualified at BSc level and the rest at MPhil and PhD level. Of the two staff assigned to Food Science, one is a PhD from Bulgaria and the other, Mr Muzariri, has an MPhil in Biochemistry. Some resource persons from the food industry are also used in teaching the course. Despite these claims, the resource capacity (staff and facilities) of the Polytechnic to run the BTech programmes has been seriously questioned and the future of the programme is under discussion with the University of Zimbabwe. Of the first intake of 50 students, 15 are in the third year in the Applied Biology and Biochemistry option. Since the Polytechnic lacks equipment and facilities for a food science laboratory, the priorities for funding such expansion must be considered against the University's own plan for Food Science and Technology teaching and research.

9.4 Grain Marketing Board (GMB)

Person contacted:

Mrs J Mutuka, Acting Training and Development Manager

The GMB has its own training school and in-house training programmes. The in-house training programme for department managers is usually run in the off-season; and incorporates practical and theoretical elements of management, safety, health, grading and pest control. A separate formal grading course is also run for depot managers, inspectors and approved buyers. Training needs are evaluated by the trainers through field evaluation and identification of problem areas. The trainers are full-time instructors based at the GMB training school and are also assisted in the courses by in-house subject matter specialists. The full-time staff of the training unit consists of 3 technical instructors, two academic trainers and one handyman.

The Research Department comprises a research manager (BSc), an assistant research manager (BSc) and three research assistants, though only two research assistant posts are currently filled by candidates whose qualifications are "A" levels and a BSc degree, with no special training in storage. The Research Department is responsible for pest control, research, pesticide and aflatoxin testing, training and monitoring of pest control teams. The assistant research manager has been identified for MSc training in Crop Storage. The GMB has three pest control supervisors whose prime function is to train and monitor the pest control teams. There are 9 pest control teams based one in each of the Provinces. These teams comprise a team leader and 12 general hands. The team leaders have "O" level qualifications and several years of on-job experience. Pest control team leaders receive comprehensive in-house training in pest control and fumigation by the Pest Control Supervisors, assisted by the Research Department.

The GMB has 6 operational silos, 3 silo complexes still under construction, and 63 depots. The depot managers and their assistants receive comprehensive training at the GMB Training School in all aspects of storage handling and management.

Apart from the in-house programmes, GMB is supported by other training schemes to strengthen its training capacity. The Food Studies Group of the EEC provides for training at all levels within the organization. In the processing area, 6 coffee liquorers were sent for a two-month training to Belgium after one year on-the-job training.

The Australian programme for SADCC countries has held two workshops to identify needs and discuss course structuring and infrastructural support. Initially 6 Depot Managers/Assistants per country will receive training on a 15-18 month correspondence course leading to a Certificate in Grain Handling and Husbandry. The Grain Marketing Board Training School will be the venue for this regional training programme.

9.5 Dairy Marketing Board (DMB)

Person contacted:

Mr Huveswa, Training Officer (Technical)

The Dairy Marketing Board is a parastatal organization responsible for the purchase of raw milk and processing and sale of milk and dairy products. It has an annual intake of about 200 million litres of milk. It is therefore one of the largest food processing operations in Zimbabwe and has a well-trained production force. Its processing operations consist of a Central Dairy Processing Unit in Harare and three provincial units in Mutare, Bulawayo and Chipinge.

The DMB currently has a cadre of 8 dairy technologists, most of whom have had specialized training in Dairy Technology added to their BSc or Food Technology degrees.

At production supervisory levels, the Harare dairy has 12 dairy supervisors and 8 production controllers, while the other three dairies collectively have 20 dairy supervisors and 6 controllers.

The production managers undergo a two-year dairy technology training in British universities, leading to a Bachelor of Technology qualification with a dairy specialization, or a one-year City and Guilds Dairy Certificate programme.

Under the current programme sponsored by the British Council, 6 production trainees are trained per year under this scheme; 3 of these are identified for production and the other 3 for laboratory quality control functions. The British Council programme is to continue for a further 3 years, at the end of which it is expected that local training capacity will be fully established. A British Council expert will also conduct an in-country course for training the trainers, and with the Learner Controlled Training Manuals developed over the last years it is expected that the DMB will be self-sufficient in training skills.

Several expansion projects are being planned or are on-stream. A dry milk powder plant is expected to be installed in the near future and the rural milk collection schemes are to be developed further. The implication of these developments in terms of manpower needs has not yet been worked out though an FAO manpower survey is shortly to be undertaken to project expansion and development needs.

Operator level mechanical and engineering skills are acquired on-the-job and provision exists for block release of technicians and operators for City and Guilds courses at the Polytechnic.

Production supervisors/controllers are recruited at school-leaving level ("O" and "A" level certification) as production trainees and undergo an 18-month in-house training programme consisting broadly of three 6-month modules on Industrial Operations, basic core Dairy subjects (milk composition, processing, products) and special product training, each of which is supported by Learner Controlled Training Manuals. Trainees are evaluated at each stage. The current intake of production trainees is 6 per year but intake varies from year to year depending on need and turnover of staff.

The DMB is negotiating with FAO for funding and establishing a Dairy Technology School, possibly to be located at Gwebi College on the lines of the Dairy Training School in Naivasha, Kenya, to run a two-year Dairy Diploma course. These plans are still under discussion.

9.6 Agricultural Colleges

9.6.1 Gwebi Agricultural College

Persons contacted:

Mr B Maphosa, Principal

Mr A Mashingaidze, Lecturer, Crop Production

Mr A Tshakalisa, Lecturer, Animal Production

Mr D Kumar, Lecturer, Agricultural Engineering

Chibero and Gwebi Colleges award a Diploma in Agriculture after a two-year course of study. The course is intended for farmers, farm managers and farm extension workers. The content of the curriculum is therefore highly production-oriented, with a minimum of post-harvest topics covered under the second year course in crop husbandry, including harvesting, processing, storage and important pests and diseases of the major crops.

In contrast to the curricula of most of the Agriculture Colleges in the region, the Chibero and Gwebi curricula are entirely devoid of a home-economics/nutrition component. The Animal Science courses provide no inputs on animal products, meat, milk, secondary and by-products. However, one staff member is to attend a three-week course at ILCA on Rural Dairy Production and Processing.

9.7 University of Zimbabwe

9.7.1 Institute of Food Science, Nutrition and Family Science

Person contacted:

Dr A Ayebo, Lecturer, Department of Animal Science

The University of Zimbabwe launched a one-year MSc programme in Food Science in 1982, for which the entry qualification was a BSc Agriculture. The course was discontinued in 1986 on the recommendation of the course co-ordinator and an expert committee appointed to review the programme, on the grounds of being inadequate in content and duration to cover all the sub-disciplines of Food Science in a sufficiently comprehensive manner as to claim professional competence of the trainees at MSc level. As a replacement a three-year BSc degree programme was proposed and a project proposal for this programme has been drawn up by an expert committee appointed by the Vice-Chancellor. The programme is to run in conjunction with parallel degree programmes in Nutrition and Family Sciences, under an Institute of Food, Nutrition and Family Science. This report was completed in March 1987 and the programmes are projected to commence in 1989 with an initial intake of 20-25 candidates per programme. The staff resources currently available at UZ (with Food Science, Home Economics and Nutrition specializations) are as follows:

Food Science - 4:
- 1 PhD Biochemistry and 1 year Food Science post-doctoral
- 1 PhD Metallurgy, MSc Food Engineering
- 1 Microbiologist - expatriate
- 1 PhD Food Science

Home Economics - Staff to be seconded from other Departments in University

Nutrition - 1 Trainee PhD Nutrition

A manpower survey in the Food Science and Technology area was carried out by Gomez and MacNeil (1985) to provide a basis for planning the BSc Food Science programme. This survey projected an annual demand of about 20 Food Science graduates per year. Due to rapid developments in several areas of food manufacturing, e.g. horticulture production and processing, high value crops such as spices, flavourings and condiments, the impetus for import substitution and export promotion, the projections of this survey must by now have increased, though it would still provide valid information on the areas of demand and deficit.

9.7.2 BSc Agriculture programme

Post-harvest or post-production disciplines are only very cursorily covered in the teaching of this programme. The components are limited to:

Crop Protection - pests of stored products
(3 hours including 1 practical)

Industrial Food Microbiology
(25 hours including 4 practicals)

Principles of Animal Products Processing
(125 hours including 25 practicals)

Harvesting, Handling and Storage of Horticulture Crops
(14 hours including 1 practical)

a proposed full course in Crop Storage and Processing
(125 hours including 25 practicals),

and reflect a lack of appreciation of post-production consideration in the training of agriculturalists.

A draft proposal for the establishment of a Department of Horticulture within the Faculty of Agriculture has been submitted to the University administration for consideration. Amongst the courses proposed at the undergraduate and postgraduate (masters) levels, full courses in post-harvest physiology, handling and advanced post-harvest physiology, respectively, would be offered. Six full-time academic staff, of whom one would be a post-harvest physiologist, and supporting technical staff have been proposed. The staffing in the proposed department would be:

1 olericulturist
1 pomologist
1 floriculturist
1 post-harvest physiologist
1 tropical plantation crop specialist
1 horticultural physiologist or plant breeder
3 laboratory technicians
2 field technicians

9.8 Industrial Training Programmes

Several of the food industries in Zimbabwe run their own in-house training programmes, e.g. the sugar industry and the milling industry. The Blue Ribbon Milling School is well-known and recognized in the region and its training programme is briefly reported on here.

9.8.1 Blue Ribbon Milling School

Person contacted:

Mr Chikwanda, Training Manager

Blue Ribbon Foods runs a four-year full-time training programme at its Milling School in Msasa, Harare. The Milling School facilities include lecture room facilities and pilot-scale milling equipment for demonstration and practical work. The curriculum consists of one year of theory, followed by three years of on-the-job milling practice. The school caters for an annual intake of 16 students and has so far trained 40 regional students. Admission requirements have been upgraded from "O" level with qualifying science subjects to an "A" level entry requirement. At the end of the course the trainees receive the Advanced Certificate in Milling of the City and Guilds, London.

9.9 East and Southern Africa (ESCA), Food and Nutrition Training Programmes (FNTP)

Person contacted:

Dr Maletilema, Nutritionist, World Health Organisation (WHO), Harare

The ECSA-FNTP is a programme of regional training courses for in-service personnel in Food and Nutrition. The courses are intended to serve intermediate level personnel from the ECSA region. The ECSA courses have been run in Zimbabwe, in conjunction with local nutritionists and experts from the ECSA regions and from the international centres for Food Science and Nutrition under the sponsorship of the Swedish International Development Agency (SIDA) and the Netherlands Government.

The ECSA course has been run for two years with an intake of about 25 candidates each year, as a 6-week course. The programme was designed to cover four topic areas:

1 Maternal and Child Health and Nutrition

2 Food Science and Technology

3 Nutrition Planning

4 Communication.

Since the demand for nutrition training has been very high with 300-400 applicants for the nutrition course over the last two years, it is intended that course offerings in the next few years will be nutrition-focused.

ECSA has placed Food Science and Technology as a second priority, and dates of implementation for this course have not yet been decided.

S E C T I O N I I

OVERVIEW AND RECOMMENDATIONS

1. Existing Infrastructure and Patterns of Growth

Within the current and next five-year national development plans of several countries of the region a distinct trend towards agro-industrial growth and development has become evident. For example, the five-year development plan of Botswana (1985-91) emphasizes livestock and crop processing, fish and horticulture production, processing and marketing. Similarly the Development Policy Statement for Malawi pursues the apparent possibilities of introducing food processing for a range of crops such as oilseeds, coffee, guar beans, cashew nuts, cassava (starch), fruits and cereals. A policy document supporting the promotion of agro-industry in Lesotho states that "the government assisted by donor agencies intends to offset increased landlessness by placing greater emphasis on developing agro-industries and agro-based businesses to employ more people". Several projects already exist or are being planned in the rural technologies area in relation to food processing, e.g. ILO/FAO fruit and vegetable production and processing. In Zimbabwe since 1986 there has been a surge of activity directed to horticulture production and the Horticulture Promotion Council as well as private producers are seeking inputs of technology in relation to storage, handling and processing.

At least three of the SADCC states have embarked on a vigorous horticulture development programme (HDP) supported by funding agencies. For example:

HDP Swaziland,	supported by	IFAD
HDP Lesotho	"	LAPIS/USAID
HDP Zimbabwe	"	EEC
HDP of ARDA	"	Government of Zimbabwe

Implicit in horticulture development is the need for a strong post-production support system in handling, transport, storage, grading and processing and marketing.

The Phase 2 Agriculture Development Strategy of Swaziland emphasizes the need for developing capacity of small- and large-scale agri-business, establishment and implementation of statutory standards (including food standards) and export abattoirs.

Against this background of rapidly expanding needs, it appears that the formal academic training institutions, universities and colleges, limited already by tight budgets and structured curricula, lack the capacity or the resilience to react to these needs rapidly enough.

The immediate alternative of short-tem intensive courses, preferably run on an in-country or regional basis, such as the Australian Regional Grain Management Programme mentioned in Section I of the report, is a more viable and cost-effective prospect. Several commodity areas for such

training can be identified, e.g. Malawi, Tanzania and Mozambique could benefit from a sub-regional fisheries training programme including production, post-production handling and processing to run in conjunction with an existing facility such as the Fisheries Training School in Malawi. Lesotho, Swaziland and Zimbabwe, countries with potential for horticulture production, could similarly benefit from a sub-regional training programme in horticulture. While several universities in the region, Zimbabwe, Botswana, Tanzania, had already incorporated horticulture including some aspects of post-production processing and marketing in their agriculture degree programmes, fisheries and aquaculture, wherever occurring, were observed to be still treated as biological science subjects, and had less of a practical, production, processing, marketing bias.

Several parastatal organizations exist in the region for the promotion of small-scale industrial development, e.g. SEDCO (Zambia), SIDO (Tanzania), RIP (Botswana). These organizations already provide some inputs of training in specific areas of small enterprise/industry. However these organizations could serve a more vigorous training function in post-production areas with more financial and human resource support.

At the industrial level, particularly in industries such as milling and brewing, infrastructure for training is already well established and the standards of training consistent with the standards of such vocational training (as in milling) of recognized overseas establishments. The industrial parastatals such as the Dairy Marketing Board in Zimbabwe, the National Milling Corporation in Tanzania, Grain Milling in Malawi (recently denationalized), the Botswana Meat Commission and the Cold Storage Commission of Zimbabwe likewise were found to have well developed in-house training schemes, supported and supplemented in some instances with external training. Generally the training capacities of both the parastatal and private industrial sector are geared to meet their own manpower needs and do not serve any long-term national need for post-production skills. However this training resource cannot be disregarded in the national or regional strategies for post-production manpower development for servicing more broad-based needs. In Zimbabwe this resource has already been utilized for the training of graduates through industrial attachments/internships on project work, albeit to a limited extent, in the MSc Food Science course (currently discontinued). The Blue Ribbon Milling School has provided training for the regional milling industry for about 40 students from Zambia and Mozambique.

These alternatives do not, however, remove the long-term training need of providing graduate and postgraduate level manpower from the universities.

2. Training and Manpower Needs

2.1 Analysis of Constraints

In most instances it was easier to identify formal institutional training capacities at the levels reflected in Table 1. At the lower levels of semi-skilled, artisanal/journeyman training the specificity in relation to post-production skills and functions becomes less defined and in both the training and employment sectors the requirements in these categories are more generalized in terms of mechanical/manual skills involved in machine minding or operating. It was therefore not attempted to assess this level of manpower or training in any detail, though in several of the organizations covered in the survey, operator training was indicated as essentially on-the-job in-service training.

The study was able to achieve a reasonable estimate of current manpower status and training programmes in most of the nine SADCC states (Table 13). However, the evaluation of manpower needs in the post-production disciplines within an institutional or national framework was a more difficult task, since there were several constraints to defining these needs clearly:

- Wherever national manpower surveys existed, e.g. Zimbabwe, the post-production sector was not covered as a specific category per se but was generally covered under broader classifications such as agriculture or manufacturing.

- On a national scale, and particularly in the public sector, projections of needs are a direct function of the capacity to create and absorb employment. This is limited by budgetary constraints and in some cases by freezes on posts recruitment. There could therefore be a significant disparity between actual needs (for sustaining and fuelling dynamic and healthy economic growth and apparent needs (limited by prevalent economic constraints).

- Manpower needs in the post-production sector are less understood and appreciated than production sector needs. The employment market for post-production specialists has to be educated and sensitized to the needs. For example, quality control in food processing and the food industry is under-serviced and so is the area of statutory food control. Grain storage and handling has only recently been perceived as an essential element of a national food strategy.

- Within institutional frameworks in the private sector, though theoretically manpower needs should be dictated by production capacities and market needs, in practice they were affected by factors such as wage and

employment policies. Estimates and projections of needs tended to be conservative rather than optimistic. In several enterprises, planned expansion in output was based on expansion of installed processing capacity and not on expanded manpower needs.

2.2 Generation of needs and demands

It would seem from the above that manpower needs and demands in the post-production sector could be effectively generated only through active research and development (R&D) programmes that will diversify and expand both domestic and export markets and fuel the machine of industrialization. Private sector R&D capacity is very limited and virtually non-existent in the region. The long-term approach to maximizing food resources of the region through correct storage, conservation and processing technologies becomes more a public sector responsibility. Infrastructural capacity for such public sector research already exists in most SADCC countries - TFNC in Tanzania, NCSR in Zambia, Foods Laboratory in Botswana and UDRA in Mozambique. But they have not been able to achieve dynamic growth and output for lack of skilled manpower, or funding, or both. The manpower capacity at TFNC is impressive in comparison with other similar organizations (Table 9), yet there has been no significant headway in research output. Where institutional capacity such as TFNC exists, budgetary limitation could be overcome not only by dependance on external project funding but also by contract research on a country or regional basis.

Table 13: Formal tertiary level training capacities in SADCC in agriculture disciplines (including some components of post-production)

Country	Course offering	Current no./year	Projected numbers
Angola			
Augustino Neto University	BSc Agric. (Crop Science & Animal Science)	10	-
	BVSc		
Botswana			
Botswana Agricultural College	Diploma in Agric.	17	
	Cert. in Agric.	47	
University of Botswana	BSc Agric. (proposed)	-	25-50
	Dip. (2 yr) Agric.		40
	Cert. Agric.		60
	Dip. Animal Health		30

Country	Course offering	Current no./year	Projected numbers
Lesotho			
Lesotho Agricultural College	Dip. Agric. (2 yr)	35-40	-
	Dip. Home Economics	20-25	-
Malawi			
Polytechnic	Dip. Agric.	n.a.	-
	Cert. Agric.	n.a.	-
Bunda College	BSc Agric.	30	-
	Home Economics (option)	10	-
Natural Resource College	Farm & Home Science Department	30	50
Mozambique			
Eduardo Mondlane University	BSc Agronomy	20	-
	Food Technology (option)	10	30
Swaziland			
University of Swaziland	BSc Agric.		
	Home Economics	20-25	32
Tanzania			
Sokoine University	BSc Crop Science	28	
	BSc Animal Science	28	
	BSc Agric. Engineering	16	
	BSc Food Science	15-20	
Zambia			
University of Zambia	BSc Agric.	50	
	Post Harvest option	6-7	
Natural Resources Development College	3 yr Diploma:		
	Agriculture	60	
	Nutrition	30	
	Agric. Engineering	18	
Zimbabwe			
University of Zimbabwe	BSc Agric:		
	Animal Science	30-35	
	Crop Science	30-35	
	Soil Science and Agric. Engineering	30	
	Crop Storage course commencing 1989		10-15
	MSc Food Science (1982-1986)	8-10	
Polytechnic	B.Tech.	50	
	Applied Biology and Biochemistry option	20	

2.3 Patterns of employment

Except in the agriculture colleges, where by and large a high proportion of the diplomates and certificate holders were absorbed into extension services within the ministries of agriculture, other tertiary institutions had little information on the follow-up and employment patterns of their graduates, viz. those with specialisations in post-production disciplines.

In Zimbabwe, the study by Gomez and MacNeil (1985) analysed the employment pattern of MSc Food Science graduates in the period 1983-86. Their survey indicated that the public sector, including parastatals and universities, was the largest employer of these graduates.

The employment breakdown of the 19 MSc Food Science graduates is as follows:

Year	Number graduating	Employment				
		Private sector	Para-statals	University	Government sector	Other
1982-83	6	3	-	1 (FS-SDF) 1 (FS-PhD, private)	-	1 (UNDP)
1983-84	2	-	1	1 MPhil (non-FS)	-	-
1984-85	6	-	2	1 Technician (non-FS)	3	-
1985-86	5	2	1	-	1	1 (Educ)
	19	5	4	4	4	2

FS = Food Science
SDF = Staff Development Fellow
UNDP = United Nations Development Programme

A significant observation of the study was also that a high percentage of respondents did not see the need for postgraduate level training in food science and indicated a diploma or BSc level as adequate. This response is also indicative of the deficit of R & D activities in both public and private sectors and a general under-estimation and under-

awareness of the functions and role of the post-production disciplines.

In Tanzania 15 - 20 BSc Food Science and Technology graduates from Sokoine University and about 50 diplomates from agriculture colleges having post-production and home economics programmes (e.g. Uyole and Ilonga Agricultural Colleges) enter the Food and Nutrition Division of the Ministry of Agriculture and Livestock Development per annum. These cadres support the Tanzania Food and Nutrition Centre and international food and nutrition projects.

3. Overview of Regional Training

3.1 Tertiary training

At tertiary level, in university curricula, training in post-production disciplines was fragmentary except in Tanzania and Mozambique where definite degree/special option programmes existed or were proposed in Food Science and Technology. Storage was essentially a component of Crop Science/Agric. Engineering courses and of not more than 30-60 hours. The strongest degree programmes in post-production disciplines were those of Tanzania, Sokoine Agriculture University. In those universities with developed Agricultural Engineering programmes there is room for introduction of interdepartmental courses in Crop Handling, Processing and Storage, in conjunction with Crop Science departments.

Agriculture colleges awarding diplomas and certificates in agriculture were also deficient in the post-production disciplines and training. Consequently this deficiency was evident at the level of extension services and farmer training.

A consultancy undertaken for SADCC (Nygaard et al.) in 1985 on Training of Agricultural Scientists in Southern Africa makes no mention of the manpower availability, needs and requirements in the post-production system or Food Science and Technology (except for the Sokoine University programme). The report is indicative that training in these disciplines at university and college (tertiary) level is rather limited.

The fundamental sources of trained manpower are the universities as, by and large, it is the university graduates who become the trainers at the colleges and institutions who train the diploma and certificate cadre and who undertake the in-service training in extension services. Thus the first step in the longer term process of ensuring that the post-production sector of food systems gets due attention lies in their promotion at universities. At present there are small pockets of research work going on in post-production aspects. These researchers could be utilized as resource personnel and their material introduced into curricula.

There is, therefore, an urgent need for agriculture training programmes to revamp and modernize their thinking and curricula towards agriculture not merely as a production-oriented activity but a whole food systems discipline incorporating the post-production components of the food system. This could be a critical determinant to planning and attaining food security for the region.

Where the need for training in post-production disciplines was a perceived need as in agricultural research departments, grain marketing boards, and food-related parastatals, candidates were sent for external training to centres such as Kansas State University, ODNRI, or for short term training to regional centres such as the FAO Dairy Training School in Kenya, or Egerton College (Kenya). University Home Economics departments were on the whole more sensitive to the need for food science/technology inputs into the curriculum than were agriculture programmes. In Malawi and Swaziland a move to develop food science strengths within the Home Economics Department was evident in both curriculum reform and in training of one PhD in Food Science.

These initiatives are well-intentioned and directed to fill a need but require more careful consideration.

3.2 Vocational

In both storage and commodity technology areas (dairy, meat, cereal-milling) training needs and capacities were more evident at the vocational training and industrial level and a major and continuing role is seen for training centres such as:

- the FAO Meat Inspectors and Meat Technologists Programme, Botswana
- Dairy training, Naivasha, Kenya
- Industrial milling schools:
  Blue Ribbon Foods, Zimbabwe;
  Grain Milling, Malawi (proposed)
- Grain handling, storage, grading:
  GMB, Zimbabwe
  ADMARC, Malawi

(see also Table 14)

Other proposed and existing bilateral/technical aid regional training programmes such as ECSA (Food and Nutrition) and the Australian Regional Grain Management Programme need to be continued, strengthened and diversified. Similar programmes in horticulture, product handling, grading and processing, in

weaning food formulation and processing, need to be explored and pursued with agencies such as EEC or WFP.

Existing private industry resources and facilities such as those of the canning and milling industries may be effectively harnessed to provide support inputs into such in-country courses.

Table 14: Commodity technology regional training capacities

Technology area	Centre/facilities
Dairy technology	FAO Dairy Training School, Naivasha, Kenya Egerton College, Kenya (Diploma Dairy Technology/Food Tech.) University of Nairobi, Dept of Food Science and Technology Dairy Marketing Board, Zimbabwe Kenya Co-operative Creameries ILCA Dairy Processing, Training Course
Meat technology	FAO Regional Training Centre for Meat Inspectors and Meat Technologists, Botswana Cold Storage Commission, Zimbabwe Botswana Meat Commission
Milling technology	Blue Ribbon Milling School, Zimbabwe Grain Milling, Malawi (proposed)
Dehulling technology	Rural Industries Innovation Centre, Kanye, Botswana

3.3 Regional and International Training Programmes

3.3.1 FAO Regional Training Centre for Meat Inspectors and Meat Technologists in Africa

The above programme has been included in the country reports under Botswana because of its location. However it is a regional programme in that its mandate extends to all of Africa. The formal training programme runs two courses per year with an enrolment of 36 - 42 candidates per year. The Centre is, however, willing to run special short courses in selected topic areas, e.g. butchering, or meat inspection, for the SADCC countries, only provided there was sufficient

demand. With both Zimbabwe and Botswana being meat exporting countries, it may be of interest to develop a specific programme incorporating meat inspection and legislative aspects of meat quality control, particularly for export abattoirs.

3.3.2 SADCC/ICRISAT Sorghum and Millets Improvement Programme

This programme was established in 1984 with the major objective of crop improvement in the mandate crops, sorghum and millet. As part of the improvement programme SADCC/ICRISAT has incorporated food quality evaluation and crop utilization components into the sorghum and millet programme.

Part of this effort has the objective of increasing and improving sorghum consumption, which calls for development and diversification of the sorghum and millet markets. The improvement effort focuses at two levels, at the base interacting with the breeding and production disciplines and at another level looking at the product development and utilization. The programme has a strong training component and once the crop utilization facilities/laboratory are completed (1989) it is expected that training in cereal technology, processing and quality evaluation will be available through this Centre for scientists and technicians in the region. Besides in-Centre training, SADCC/ICRISAT has been engaged in strengthening the region's manpower resources through supporting graduate and postgraduate training at universities abroad.

3.3.3 Australian Grain Management Programme

The Grain Management Programme is a part of the Australian Government aid programme to Southern Africa, designed and administered through the Australian International Development Assistance Bureau (AIDAB). The training programme is aimed at addressing some of the common problems shared by SADCC countries in the area of post-harvest grain losses, and the shortage of technical and management skills in grain handling, storage and marketing. The focus of the programme is strengthening the grain handling authorities in Lesotho, Botswana, Malawi, Swaziland, Tanzania, Zambia and Zimbabwe. This will be achieved by providing accredited training programmes for middle and senior management employees using a distance education strategy and by strengthening the central training units of grain handling organisations.

There are three components in the programme:

i) A Certificate in Grain Husbandry, to be studied by distance education. Successful students will be awarded the Certificate in Grain Husbandry from the Technical

and Further Education External Studies College of Western Australia (TAFE). The training materials have been developed by the Western Australian Institute of Grain Management. This material will be adapted to the needs of SADCC.

ii) A parallel strategy will be strengthening of national training units through training of trainers workshops to be held sub-regionally. These workshops will concentrate on training techniques, tutoring, student counselling and administration of distance education courses.

iii) Strengthening central training units of grain handling authorities with the supply of training equipment and resource materials.

The numbers of trainers identified from each of the participating countries are listed in Table 15. The training needs and country priorities in the Grain Management/Storage and Marketing areas are given in Table 16.

Table 15: Number of Training Officers identified to assist in the Australian Programme

Country	Training units staff		Total number of training staff
	Central office	Regional office	
Botswana	2	-	2
Lesotho	3	-	3
Malawi	2	-	2
Swaziland	-	3	3
Tanzania	3	20	23
Zambia	4	10	14
Zimbabwe	3	2	5

Source: Whittaker and Green (1987)

Table 16: Training Needs and Country Priorities

Training	Bots	Les	Mal	Moz	Swaz	Tan	Zam	Zim
Grain grading/sampling	–	1	2	1	2	1	3	20
Cereal chemistry	–	16	23	–	6	18		21
Storage management (pest) control, grain hygiene, fumigation, inspections)	1	2	1	2	1	2	2	2
Stores and supply management	5	4	3	–	–	2		18
Machinery maintenance (including transport)	6	5	7	0	3	5		19
Sales and marketing management	–	6	9	–	13	12		4
Grain distribution planning	2	7	4	4	3	4	1	7
Grain accounting	14	8	5	8a	8	3		15
Financial planning and budgeting	11	10	6	5	7	14	7	14
Records management	9	12	15	–	4	3a		17
Management information systems	7	14	13	3	12	11	8	5
Principles of management and administration	3	–	8	6	–	6		16
Factory production management	–	17	10	–	–	15		8
Depot management	12	13	12	–	5	8	4	1
Internal auditing	13	9	14	7	8	13	6	6
Corporate planning	–	18	22	–	10	7		11
Supervision for line managers including health and safety	8	–	11	–	7b	8a		3
Personnel management and labour relations	4	15	16	–	14	19		13
Milling technology	–	11	21	–	–	16		22
Baby foods/bakeries (nutrition/technology)	–	–	19	–	–	17		23
Quantitative methods and forecasting	–	–	18	–	–	21		12
International marketing including export/import control, port handling procedures and law	–	20	17	–	13	10		10
Public relations	–	19	20	–	9	9		9

Source: Whittaker and Green (1987)

Forty-nine students, seven from each of the seven participating countries, will be enrolled in the Certificate of Grain Husbandry course. Students must pass 13 units, 10 units studied as distance education modules and 3 units studied in face-to-face lessons during tutorial workshops. Each of the units to be studied by distance education has individual study lessons and assignments to be completed and sent to Australia for marking. To gain certification a student must successfully complete all course units. The course units have been carefully chosen in consultation with all participating countries. The units include:

- Units to be studied by distance education -
  - Grain Storage
  - Pest Control I
  - Communications A
  - Grain Sampling
  - Organisation 1A
  - Supervision A
  - Pest Control II
  - Grain Handling
  - Supervision B
  - Organisation 1B

Local units to be studied during workshops -
- Distribution Management
- Marketing I
- Grain Accounting

The Training of Trainers Workshops are aimed at enhancing the skills of the training officers in the grain handling authority training units. Activities are designed to cover two main areas; training officers will be assisted to acquire skills in providing support and counselling for students in the Certificate course as well as gaining expertise in administration. Other activities will focus on techniques of training which the training officers will be able to utilize in their own in-country training programmes.

Country representation at the Training for Trainers Workshops is on a proportional basis according to the number of training officers employed in each country.

Mozambique and Angola are not participating in this programme, due primarily to language difficulties. However, it is proposed that a similar programme in Portuguese be offered to the two countries.

4. RECOMMENDATIONS

i) An information base on the existing resources of:

- qualified technical and professional personnel in post-production storage scientists and food technologists should be developed on the background information provided in this report, through an appropriate questionnaire and through use of other sources such as the SACCAR directory of regional agriculture experts.

- Training programmes and facilities available in SADCC and the PTA region for post-production training, research and services should be developed.

ii) A Directory or source book of information should be compiled from this data base, as a useful reference for planning, policy and development programmes.

iii) As indicated in this report, there is a rapidly growing gap between the needs and aspirations expressed in the agriculture and food strategies of SADCC and the commitment and capacity of the tertiary institutions to post-production training. Recognizing this and the existing vacuum in post-production training, it is recommended that SADCC/PFIAU catalyze and motivate a meeting of the Deans of Agriculture of Southern African Universities to discuss the issue of post-production training with particular reference to the agro-industrial development policies of their countries.

iv) The results and resolutions of such a meeting may be made the basis of a Policy Paper for a Council of Ministers meeting or for presentation to the highest levels of SADCC policy making.

v) SADCC/PFIAU within its own mandate could carry out the following recommended activities:

- Facilitate and promote, intersectoral and inter-regional meetings of university, research, industry, government ministries (agriculture, trade and commerce and industry) representatives to articulate and review needs, identify constraints to development of post-production manpower and resources. The possibilities of resource-sharing indicated in this report should be explored in practical terms.

- In consultation with appropriate recipients, some of whom have been indicated in this report, promote the sponsorship of post-production training in high-interest/priority areas, e.g.
  Horticulture handling, grading and processing
  Fisheries handling and processing
  Weaning foods formulating and manufacture
  Small-grain processing and utilization
  Food (solar) drying technologies
  on an inter-regional or sub-regional basis by donor or technical aid agencies.

- Facilitate networking between institutions with post-production capacity, such as TFNC, NCSR and UDRA to interact and report on focussed issues such as:
  (a) Resource-sharing
  (b) Co-operative research/training
  (c) Inter-institute training programmes

vi) Elicit and collate information from specific proposed regional and national programmes/projects in the post-production area, such as:

- Centre for Agriculture Research and Development (CARD) in Malawi

- FAO Regional Plant Protection Services Centre

- TFNC, National Manpower Needs Assessment Survey for establishing a Food and Nutrition Training School in Tanzania

- Manpower and Needs Assessment Survey by the University of Zambia as a basis for planning the proposed food science and technology programme

- Proposed FAO/DMB Dairy Technology Training School in Zimbabwe.

vii) Explore the potential of the private industry and parastatal sector to provide resource personnel and facilities for specific areas of commodity training.

viii) Facilitate strengthening and upgrading the capacity of Small Enterprise Organizations such as SIDO, SEDCO, RIIC, through availability of short-term technical experts in specific commodity processing, and in providing training opportunities for staff.

ix) Encourage recognized external programmes and courses such as those provided by ODNRI (storage of durable and perishable produce), Silsoe College (post harvest technology) or Kansas State University (crop storage and marketing) to be run within the region to benefit a larger number of regional candidates.

x) Strengthen and rehabilitate the existing but under-utilized infrastructure for food technology training and research at Augustino Neto University in Angola and at INIA in Mozambique. The assistance of countries such as Tanzania that are well-served in this area and are approaching a surplus situation may be sought to provide manpower and expertise.

xi) Explore more fully, individual training needs such as those indicated in this report, e.g.

FNDC and Basotho Fruit and Vegetable Canners, Lesotho, for the training of two food technologists

to identify and secure sponsorship.

xii) The Home Economics and Nutrition Training Programmes are offered mainly at Certificate level in most SADCC countries except in Tanzania, where they are full degree programmes. In several countries, e.g. Malawi, Swaziland and Lesotho, dissatisfaction was expressed with the present level and input of food processing/preservation components in the curricula. Malawi and Swaziland had proposed curricula changes incorporating higher post-production inputs. However, the grafting of food technology/food science inputs into the home economics programmes cannot be undertaken piecemeal and must be accompanied by a general upgrading of the level and quality of home economics programmes through, for example:

- Admission requirements of biological science and physical science preparation
- Higher academic levels of admission requirements.

It is recommended that a body such as ECSA Programme should examine the home economics and nutrition training needs in the region in greater depth.

Appendix I

PERSONS CONTACTED

BOTSWANA

Botswana Agricultural Marketing Board
Mr S Taukobong, Deputy General Manager

Southern African Centre for Cooperation in Agricultural Research
Dr M Kyomo, Director
Dr D Wanchinga, Manpower and Training Officer

Department of Agricultural Research
Dr D Gollifer, Director of Research

Botswana Meat Commission
Mr Mpuang, Personnel and Training Manager

Food and Agriculture Organisation Training Centre for Meat Inspectors and Meat Technologists in Africa
Dr E Bellino, Animal Health and Meat Hygiene Officer

Botswana Development Corporation Ltd, Agriculture Division
Mr Bons, Crops and Irrigation Specialist

University of Botswana, Faculty of Agriculture
Prof. G Mrema, Dean

Rural Industries Innovation Centre
Mr S Dinat, Business Manager

Food Laboratory Botswana
Mr V Sharma, Manager

MOZAMBIQUE

Agricom
Miss D Duncan, Technical Officer, Technical Department
Mrs L Come, Personnel Officer
Mr Nacimento, Head, Technical Department
Mr H da Silva, Marketing Officer, Supply Department

Faculty of Agriculture and Forestry
Dr J Rodrigues Pereira, Director/Dean

Instituto Nacional de Investigacao Agronomica
Dr M Moraes, Director

Unidade Direcion Duramo Alimentaire
Mrs L da Silva Carrilho, Food Technologist

MALAWI

Bunda College of Agriculture
Dr Ngwira, Dean
Dr B Mtumuni, Head, Dept of Home Economics
Mrs G Cussack, Lecturer in Nutrition
Dr Chiyenda, Head, Dept of Crop Production

Ministry of Agriculture
Mr Sichinga, Chief Statistician
Ms I Chikagwa, Extension Specialist
Mr C Makato, Research Officer

Chitedze Research Station
Dr Sibale, Head of Station
Mr Kapiwa, Technician, Grain Storage Unit

Natural Resources College
Mr F Mbuka, Principal
Mrs D Mateyo, Head of Division of Farm and Home Science

Malawi Dairy Development
Mr A Walls, General Manager

Agricultural Development and Marketing Corporation
Mr A Butao, Regional Manager, Lilongwe

Malawi Grain and Milling
Mr C Kwizambe, Manager
Mr F Gondwe, Head Miller

SWAZILAND

Ministry of Agriculture
Mr Shabalala, Under Secretary, Training Division
Ms C Motsa, Home Economist, Home Economics Division
Mr J Masuso, Dairy Officer, Dairy Division

Malkerns Research Station
Mr C N Nkwanyana, Chief Research Officer
Mr D Gama, Senior Research Officer
Mr J Pali, Research Officer

University of Swaziland, Faculty of Agriculture
Ms M Silaula, Head, Dept of Home Economics

Big Bend Sugar Company
Mr Bayer, Training Manager

LESOTHO

Lesotho Flour Mills
Mr G M Begley, Technical Manager

Ministry of Agriculture and Marketing
Ms A Tsiame, Nutritionist, Nutrition and Home Economics Division
Mrs P Matete, Acting Head, Nutrition and Home Economics Division
Mr S Khetsi, Chief Extension Officer, Agriculture Extension Division
Mr M Koali, Senior Extension Officer, Agriculture Extension Division
Mr T Nawane, Acting Director, Research Division

Co-op Lesotho
Mrs M Takahimane, Purchasing Manager

Lesotho National Development Corporation
Mr T Musiyambiri, Projects Development Officer, Agro-industries Division

Food and Nutrition Development Corporation
Mrs M M'Peta, Director

Lesotho Agriculture College
Mrs M Pinda, Head, Dept of Home Economics

Basotho Fruit and Vegetable Canners
Ms L Lethunya, Administration Manager

ANGOLA

Ministry of Agriculture
Mr J Paulo, Agricultural Economist

Augustino Neto University, Faculty of Agriculture, Huambo
Mr C Souza, Agronomist

TANZANIA

Ministry of Agriculture and Livestock Development
Mr G Mrema, Food Technologist, Crop Production and Extension Services
Mr R Rwasa, Chief Training Officer, Training Division
Extension Services

Small Industries Development Organisation
Mr E Toroka, General Manager
Mr Limbe, Food Processing Engineer

National Milling Corporation
Mr Mollel, General Manager
Mr V Semesi, Director of Milling
Mr Msumi, Training Manager
Mr Rubibira, Training Officer

Tanzania Food and Nutrition Centre
Mr M Kepakepa, Head, Food Science and Technology Department
Mrs Misano, Principal Training Officer

Institute of Product Innovation (affiliated to the University of Dar-es-Salaam)
Mr J Jasper, Head
Mr Kuwamba, Deputy Technical Manager

Sokoine University of Agriculture
Mr Ilupanga, Associate Dean; Head, Department of Agricultural Extension
Dr N Bangu, Food Scientist; Head, Department of Food Science and Technology
Dr F Maeda, Lecturer, Food Scientist
Dr H Dihenga, Engineer, Dept of Agricultural Engineering and Land Planning
Mr Kajuna, Engineer, Dept of Agricultural Engineeering and Land Planning

FAO Larger Grain Borer Project
Mr V Ndibalema, Acting Training Officer

ZAMBIA

University of Zambia, School of Agricultural Sciences
Dr G Chibilito, Head, Dept of Crop Science
Dr Y Deedat, Entomologist
Dr Javaid, Pathologist

University of Zambia, Technology Development and Advisory Unit
Dr A Lemmens, Head

Food and Nutrition Commission
Mr P Chipuki, Acting Executive Director
Ms M Mulunga, Nutritionist

National Milling Company
Mr J Chulu, General Manager

National Agricultural Marketing Board
Mr A Kani, Commercial Manager
Mr J Chirwa, Storage Manager

Ministry of Cooperatives
Dr M Subrahmanyam, FAO consultant

Mount Makulu Research Station, Food Conservation and Storage Unit
Mrs M Zulu, Storage Training Officer
Mr J Mlimo, Storage Extension Training Officer

Natural Resources Development College
Mr D McCleery, Vice-Principal

ZIMBABWE

Agricultural and Rural Development Authority
Mr E Nzuzu, Chief Training Officer

Department of Agricultural, Technical and Extension Services (Agritex)
Mr D Ford, Assistant Chief Training Officer

Harare Polytechnic
Mr C Muzariri, Head, Department of Science and Technology

Grain Marketing Board
Mrs J Mutuka, Acting Training and Development Manager

Dairy Marketing Board
Mr Huveswa, Training Officer (Technical)

Gwebi Agricultural College
Mr B Maphosa, Principal
Mr A Mashingaidze, Lecturer, Crop Production
Mr A Tshakalisa, Lecturer, Animal Production
Mr D Kumar, Lecturer, Agricultural Engineering

University of Zimbabwe
Dr A Ayebo, Lecturer, Dept of Animal Science

Blue Ribbon Milling School
Mr Chikwanda, Training Manager

World Health Organisation, Harare
Dr Maletlema, Nutritionist

Appendix II

PUBLICATIONS AND DOCUMENTS CONSULTED

1. Agriculture Research Resource Assessment in SADCC countries, Vol. 1: Regional Analysis and Strategy (1987). USAID & SACCAR. SACCAR, Gaborone, Botswana.

2. Directory of Agricultural Education and Training Institutions in Africa (1984). FAO, Rome.

3. Nygaard, D., Makhambira, P., Mrema, G., Bonnen, J. and Panagides, S. (1985) Training agricultural scientists for southern Africa. SADCC. Submitted to th Ministry of Agriculture, Harare, Zimbabwe.

4. Whittaker, J. and Green, T. (1987). African Food Security Training Programme, Australian International Development Assistance Bureau (AIDAB).

BOTSWANA

5. Botswana Development Corporation. Annual Report 1987.

6. Botswana Meat Commission. Annual Reports 1986/87.

7. Botswana Agricultural College. Course Manual, Agriculture and Animal Health. Gaborone, Botswana.

8. Botswana Agricultural College/University of Botswana. Second Year Course Outline, Crop Science and Production (1989).

9. National Development Plan, 1985-91. (1985). Republic of Botswana, Ministry of Finance and Development Planning. Government Printer, Gaborone, Botswana.

10. National Food Strategy. (1985). Government Paper No. 2, Republic of Botswana.

11. Report on the National Food Strategy. (1985). Rural Development Council, Rural Development Unit, Ministry of Finance and Development Planning, Gaborone, Botswana.

LESOTHO

12. Annual Report. (1987). Nutrition and Home Economics Division, Ministry of Agriculture, Cooperatives and Marketing. Maseru, Lesotho.

13. Annual Report. (1987). Agriculture Research Division. Ministry of Agriculture, Maseru, Lesotho.

14. Lesotho Agriculture Situation Report (1976/77-1985/86). Agriculture Planning Division, Ministry of Agriculture, Maseru, Lesotho.

15. Lesotho Agricultural College. Formal format of proposed Diploma Home Economics Programme (ex Section 3.4 of College Catalogue).

16. Lesotho Agricultural Production and Institutional Support (LAPIS) Project.

MALAWI

17. Bunda College of Agriculture, University of Malawi. Revised Diploma/Degree Curriculum in Agriculture (1988). Lilongwe, Malawi.

18. University of Malawi Calendar (1985-87). Zomba, Malawi.

19. Natural Resources College Prospectus (1986-87). Natural Resources College, Lilongwe, Malawi.

20. Natural Resources College, Department of Farm and Home Science Curriculum and Syllabus. Lilongwe, Malawi.

21. Ministry of Agriculture and Natural Resources. Careers in the Ministry of Agriculture and Natural Resources. Lilongwe, Malawi.

22. Statement of Development Policies (1987-1996). Department of Economic Planning and Development. Office of the President and Cabinet. Government Printer, Zomba, Malawi.

MOZAMBIQUE

23. Universidade Eduardo Mondlane, Maputo. Gaida do Corso de Agronomia. (1985).

SWAZILAND

24. Annual Report (1985-86). Ministry of Agriculture and Co-operatives, Mbabane, Swaziland.

25. The Agricultural Development Strategy for the Kingdom of Swaziland. (1986). Ministry of Agriculture and Co-operatives, Mbabane, Swaziland.

26. Brewin, D. (1987). Grain Storage and Milling Project, Progress Report on Training. National Milling Corporation, Tanzania.

27. Cree, T.J. (1986). Study of Storage and Processing of Sorghum and Millet. United Republic of Tanzania, Agri Systems (Overseas) Ltd.

28. Kawamba, S. and Protzau, P. (1987). IPI - An Institute of the University with Business Bias. Institute of Product Innovation, University of Dar-es-Salaam, Tanzania.

29. National Milling Corporation Training Programme, 1985-86, and 1987-88. National Milling Corporation. Mimeo. Dar-es-Salaam, Tanzania.

30. Ndibalema, U. and Morley, G. (1987). Training in improved storage and larger grain borer control. Mimeo.

31. Ministry of Agriculture and Livestock Development. Report on the Re-orientation of the Agriculture Home Economics Course at Uyoke Agriculture Centre, Mbeya. Dar-es-Salaam, Tanzania.

32. Sokoine University of Agriculture. (1988) Regulations for BSc Agric. Engineering. Calendar of Sokoine University of Agriculture, Morogoro, Tanzania.

33. Sokoine University of Agriculture. Syllabus for BSc Food Science and Technology. Morogoro, Tanzania.

ZAMBIA

34. Annual Statement of External Trade. Vol. 1: Imports, Exports and Re-exports. Central Statistical Office, Republic of Zambia.

35. Ministry of Higher Education, Development and Planning Unit. Educational Statistics 1984.

36. Natural Resources Development College. College Handbook. Zambia.

37. Nkanza, P.K. (ed). University of Zambia, Technology Development and Advisory Unit Newsletter. Vol. 1(1). TDAU, University of Zambia, Lusaka, Zambia.

ZIMBABWE

38. Gomez, M.I. and MacNeil, J.H. (1985). A survey of technical manpower needs in the food industry in Zimbabwe. Food Science Programme, University of Zimbabwe. Mimeo.

39. Prospectus, Chibero and Gwebi Colleges of Agriculture. Ministry of Agriculture, Zimbabwe.

40. University of Zimbabwe, Faculty of Agriculture. Course outlines, Department of Crop Science.

41. University of Zimbabwe, Department of Soil Science and Agricultural Engineering. (1988) Proposal to amend regulations to introduce a new course in Crop Storage and Processing as elective in Part III.